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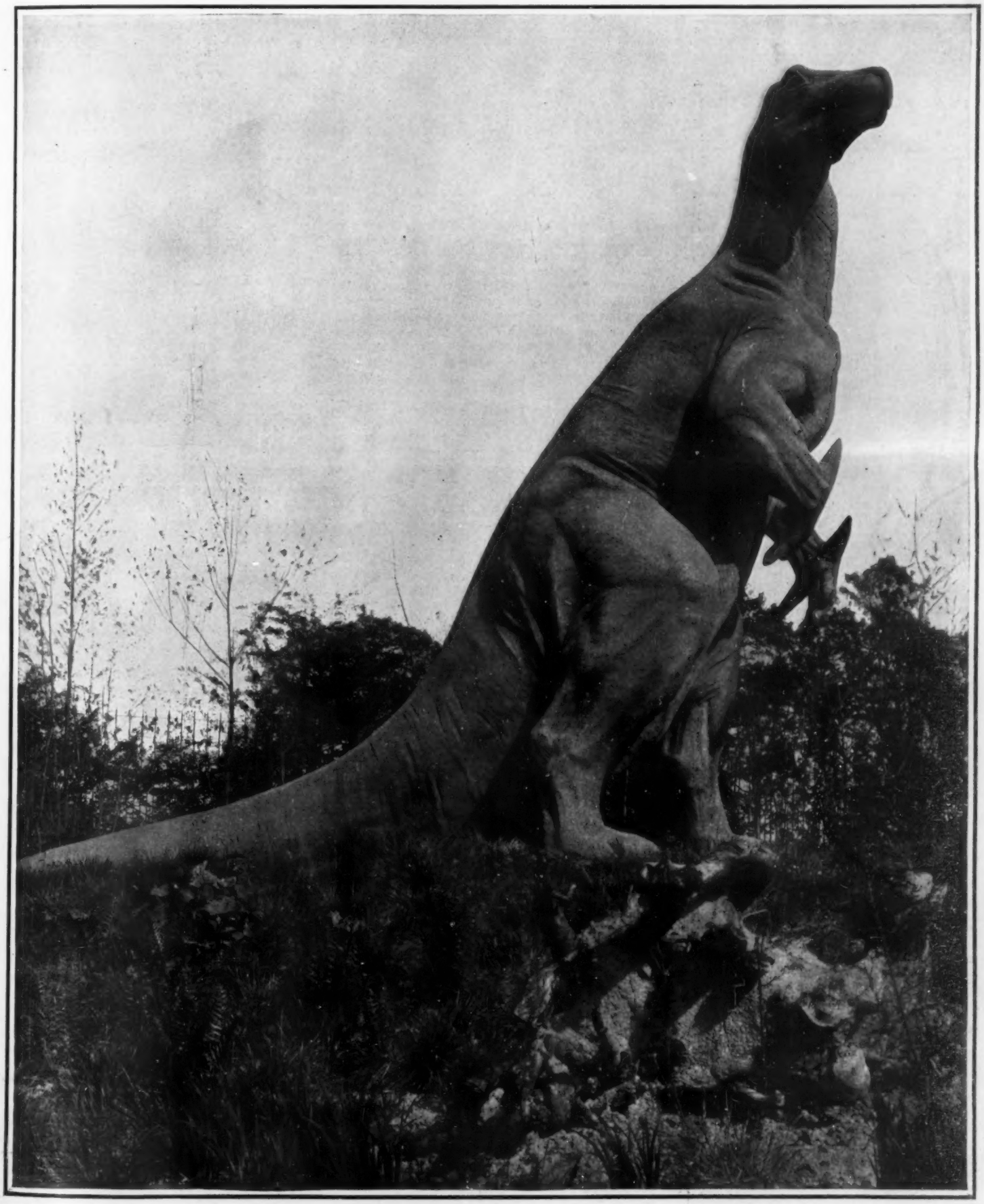

Iguanodon—This specimen towers twenty-five feet in the air, making the trees around look small.

A DINOSAUR THAT ROAMED THE EARTH MILLIONS OF YEARS AGO.—[See page 352.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Sport for Sport's Sake

THE presentation of the SCIENTIFIC AMERICAN Aviation Cup to Mr. Glenn H. Curtiss, as recorded elsewhere in this issue, gave the donors an opportunity to draw attention to the sportsmanlike spirit displayed by the winner in his persistent quest of this trophy. Although Curtiss is engaged in the manufacture and commercial exploitation of aeroplanes, and is therefore a professional, he has exemplified the best traditions of the amateur in his three-year quest of a trophy which brings no cash to the winner, and whose principal value lies in the distinction which it confers. The SCIENTIFIC AMERICAN has always deplored the fact that there was no competition for this trophy, and our regret was due, not so much to the consideration that we were its donors, as to the fact that the lack of interest in the cup proved that the spirit of commercialism was dominant among the ranks of the aviators, not one of whom, outside of Curtiss, cared to turn momentarily aside from the hunt for large money prizes and make an effort to win a cup which has the distinction of being the first trophy of any kind offered in America in connection with the new art of aviation.

It is most unfortunate that not only here, but in Europe, the commercialization of the practical exponents of the sport seems to be complete. There has not been wanting evidence of a combination among the professional flyers for the purpose not only of securing the largest possible cash prizes at public meets—and in all conscience they would seem to be big enough at the present figures—but of taking charge of the meets themselves and flying or not, just as the whim or convenience of the occasion might happen to determine.

Let it be understood that we have no prejudice whatever against the professional airman. When he hangs his life in mid-air, upon a flimsy fabric of wood, canvas and wire, for the special delectation of an assembled multitude, it is perfectly proper that they should pay adequately for witnessing his game of chance with Death. Moreover, aeroplane sport is costly, and not many among the airmen have the private means to enable them to last very long at the game. What we do regret, however, is that in the midst of all this money-getting, one looks almost in vain for the relieving contrast of a touch of the true old sporting spirit; the spirit which in other lines of sport is cherished and guarded so assiduously by various amateur associations throughout the world. Now there can be no question that the undoubted popularity of the winner of the SCIENTIFIC AMERICAN Trophy is largely due to the conscious or unconscious recognition of the fact that he has in him, despite his professional standing, a strong dash of the true sporting instinct; and we commend his successful quest of this trophy to the consideration of the younger race of airmen, to whom we must look for the rescuing of the sport from the rank professionalism into which it has fallen.

Fire Drills in Factories

THE only redeeming feature of such a horrible catastrophe as the recent fire in a shirt-waist factory in this city, in which nearly 150 people, largely young girls not out of their 'teens, were killed, is the fact that it serves to stamp upon the public and official mind certain imminent dangers, which, but for such a frightful object lesson, would remain unnoticed and uncorrected. In the presence of such a horror, it is futile to moralize—the best we can do is to point out the practical lessons of the disaster and leave it to legislative authority to make sure, as far as possible, against its recurrence.

Above everything, this fire has shown the need in all crowded factories of this character for the institution of a system of fire drills, similar to that which is practiced in our public schools. The majority of the unfortunates who lost their lives were young people of foreign parentage, and it needed only the occurrence of some sudden emergency such as an outbreak of fire to throw them into a state of uncontrollable panic. If the manufacturers who are engaged in making shirt-waists, feathers and flowers, and other goods of a highly inflammable character, are to be permitted to crowd the upper floors of buildings with machines and operatives, the law should make fire drills compulsory, and the officials of our city should see to it that they are most strictly carried out.

Again, if, in crowded workrooms, it is inevitable that there will be a considerable accumulation of the goods, either in a partially complete or a finished condition, it should be made compulsory for the landlord or the lessee to install an effective system of automatic sprinklers over the whole floor. In the case of the late fire, it seems that the flimsy goods were hung in rows above the operators' heads, and that as soon as the fire started, it ran through the stuff as though it was so much tinder. An efficient system of fire sprinklers would either have put out the conflagration or so far held it in check as to give the work people a reasonable time for escape.

In this, as in every great fire disaster, involving the destruction of large and panic-stricken crowds of people, the question of adequate means of egress is shown to be all important. Whether or not such stairways and fire escapes were provided as the building law requires, the fact remains that they were quite insufficient to deal with the emergency. No hard-and-fast rule can be laid down which will cover broadly the needs of all buildings. What we mean is that the number of fire escapes and other means of egress should have strict reference to the uses to which the building is to be put. The fire escape capacity which is sufficient for an office building is manifestly too small if it has to serve a ten or twelve-story building whose various floors are teeming with the excitable and easily panic-stricken sons and daughters of the immigrant from central Europe.

Newspaper Science

A RECENT press dispatch described the experiences of the passengers and crew of a transatlantic steamer who were treated to a display of that very commonplace phenomenon, St. Elmo's fire. The usual brush discharge from the tips of masts and spars appears to have caused about as much excitement on board as might have been expected from an appearance of our old and, of late, quiescent friend, the sea serpent. The captain is reported to have studied the phenomenon attentively for some time, and at last to have given his opinion that it was a case of "St. Thomas's fire." Passing over the astonishing fact that an entire ship's company, in this year of grace 1911, were apparently quite unacquainted with a natural phenomenon that has been the subject, not only of scientific research, but of the most banal literary allusion for at least two thousand years, and that even the intelligent skipper could only recall vaguely that he had heard of something of the sort and that it was called after some saint or other, what shall we say of a newspaper that publishes an account of the event as a marvelous occurrence, and is obviously unable to give the phenomenon its correct name? Will not some philanthropist found a newspaper whose staff possesses just the rudiments of a scientific education? Wo to the scientific man who permits himself to be interviewed by the newspapers! Wo to the scientific man whose achievements, with or without his consent, are written up in the daily press!

The mere terminology of every-day science appears to be an unknown tongue to the journalistic fraternity. In this respect, however, it may be some consolation to the persons to whom this criticism is addressed, to be told that they err in distinguished company. One of Maeterlinck's plays contains the following stage direction: *"A comet suddenly shoots across the sky."* Comet, indeed! It is doubtful whether even the *Coloma Boomer*, of lamented memory, could have surpassed this.

A Change of Opinion

EVERYONE who is familiar with our columns knows that for many years past the SCIENTIFIC AMERICAN has been a strong advocate of the policy of building some of the new warships in such government navy yards as are equipped to do this work. We believe, however, that conditions have so far changed that, for the future, warship building should be discontinued at the navy yards, and all contracts for new construction should be given to the private yards.

There is no inconsistency in this change of opinion, which is due entirely to altered economic conditions, which, in our opinion, have met and satisfactorily answered the arguments that we advanced a dozen years ago in favor of building warships at government yards.

In those days, when all new naval construction was given to private builders, costs were high and progress was very slow. We advocated the policy of having under construction at least one battleship at a navy yard, on the ground that because of the inevitable rivalry which would be created between the private and the government yards, progress would be accelerated and there would be an inevitable reduction of costs. Moreover, formerly it was the custom, after the annual target practice, manoeuvres, etc., to send the whole fleet, or the greater part of it, at once to the navy yards, crowding them with work and necessitating the employment of a large force of skilled labor. When the overhauling, re-fitting, etc., were completed, the fleet would go to sea; there would be an immediate drop in navy yard activity; and a large portion of the force would have to be disbanded. It was considered that if a large government ship were on the stocks, it would be no longer necessary to disrupt the forces every year, the men being moved over from repair work to new construction when the fleets moved out of the yards for the summer cruising.

The arguments advanced were plausible, and the results obtained justified the new departure. The "Louisiana," sister ship to the "Connecticut," (the first battleship to be built under the new plan), was built in record time, and set a new mark in contract work, both as to speed of construction and cheapness of cost. To-day, ton for ton, we are building as quickly and as cheaply as the leading yards of Great Britain and Europe; and the government is getting its contract-built vessels at such a low figure that it is altogether impossible for our navy yards to make any successful competition.

The movement for navy-built ships found its most powerful advocate among the corps of naval constructors. Naturally, they are proud of the results accomplished, and because of their close identification with navy yard development, their sympathies would naturally lead them to favor, if they could do so consistently, a continuance of the policy. The naval constructors, however, are now opposed to navy-built ships, and Chief Constructor Watt is on record as stating that the building of the "New York" at the Brooklyn navy yard will involve an additional outlay of over a million and a half dollars, above what she would cost if built by private contractors.

Furthermore, the policy inaugurated under Secretary Meyer's administration, of composing our Atlantic fleet of divisions of five, with one ship at a time of each division proceeding to the navy yard for annual overhaul, has had the good effect of distributing the repair work more evenly throughout the year, and making it possible to maintain a fairly constant force of workmen at the various yards.

Thus we see that the policy of navy-yard construction, admirable at the time it was instituted, and after having achieved its purpose, has now outlived its usefulness. Furthermore, because of the stolid indifference of the public toward the question of federal assistance in the upbuilding of our merchant marine, our great shipbuilding establishments are all but starving for want of work. Were it not for warship construction, some of them would have to close their gates. This, in the event of a great naval war, would prove to be a positive calamity; for the results, even of a victorious engagement, upon the material (hulls, guns, gun mounts, etc.) of the modern battleship, would be so disastrous that there would be an immediate call for the employment of every yard, public and private, that the country possesses. It is quite conceivable that the ultimate fortunes of the next great war will depend upon the degree in which the yards are manned and equipped to meet the heavy strain that will be put upon them.

Nocturnal Warfare

An Automobile-mounted Searchlight for the French Army

By Frank C. Perkins

WE are accustomed in these days to find the automobile put to a variety of practical uses. One of the most recent developments of this kind is a traveling searchlight carried upon an automobile, and designed for military use in the French army. The general aspect of this new piece of military equipment is shown in Fig. 1 of our illustrations. The second figure shows some of the detail features of the arrangement for loading and unloading the truck for carrying the searchlight. The car can be propelled at some 19 miles an hour by an 18 horse-power motor burning gasoline, alcohol or oil, and capable of negotiating a 12 to 15 per cent grade. The fuel consumption is given as a little over 10 gallons per 100 miles. Both the automobile motor and that of the generator are of the De Dion Bouton type. The searchlight is a 7,000 candle-power electric arc lamp fitted with a 38-inch reflector. It is mounted upon a truck and can be taken from the car and set up at any suitable point within a distance of 328 feet, this being the length of the flexible current leads from the lamp to the car. The searchlight may, of course, be operated in its position on the car, if desired, but as a rule it is preferable to effect its manipulation from a distance, so as to avoid looking along the beam, and thus having a deep layer of brightly illuminated haze interposed between the eye and the object sighted, clouding the latter from view. In time of war it may also be an advantage to be able to place the searchlight in a comparatively exposed position, and yet to operate it from under cover. The device employed for this manipulation from a distance is very ingenious; without going into a full description it may here be said that its operation is based on the response of a tuning fork at the searchlight to a vibrating current sent out from a contact breaker tuned in unison with the tuning fork. There are as many tuning forks as there are different movements, each tuning fork responding to a specific contact breaker.

For field work glass reflectors are undesirable owing to their fragility. Silvered metal mirrors are unsatisfactory owing to the fact that they become tarnished under the influence of the electric arc. Of late gilded mirrors have been used with success. The brightness of the electric arc may reach a figure as high as 250 candle-power per square millimeter. By the way of comparison it may be mentioned that lime light gives at most only 8 candle-power for the same area. The light comes almost entirely from the positive carbon, and the two electrodes are placed accordingly, so as to give the best effect. With a reflector of 60 inches diameter good observations can be made at a distance of from two to three miles.

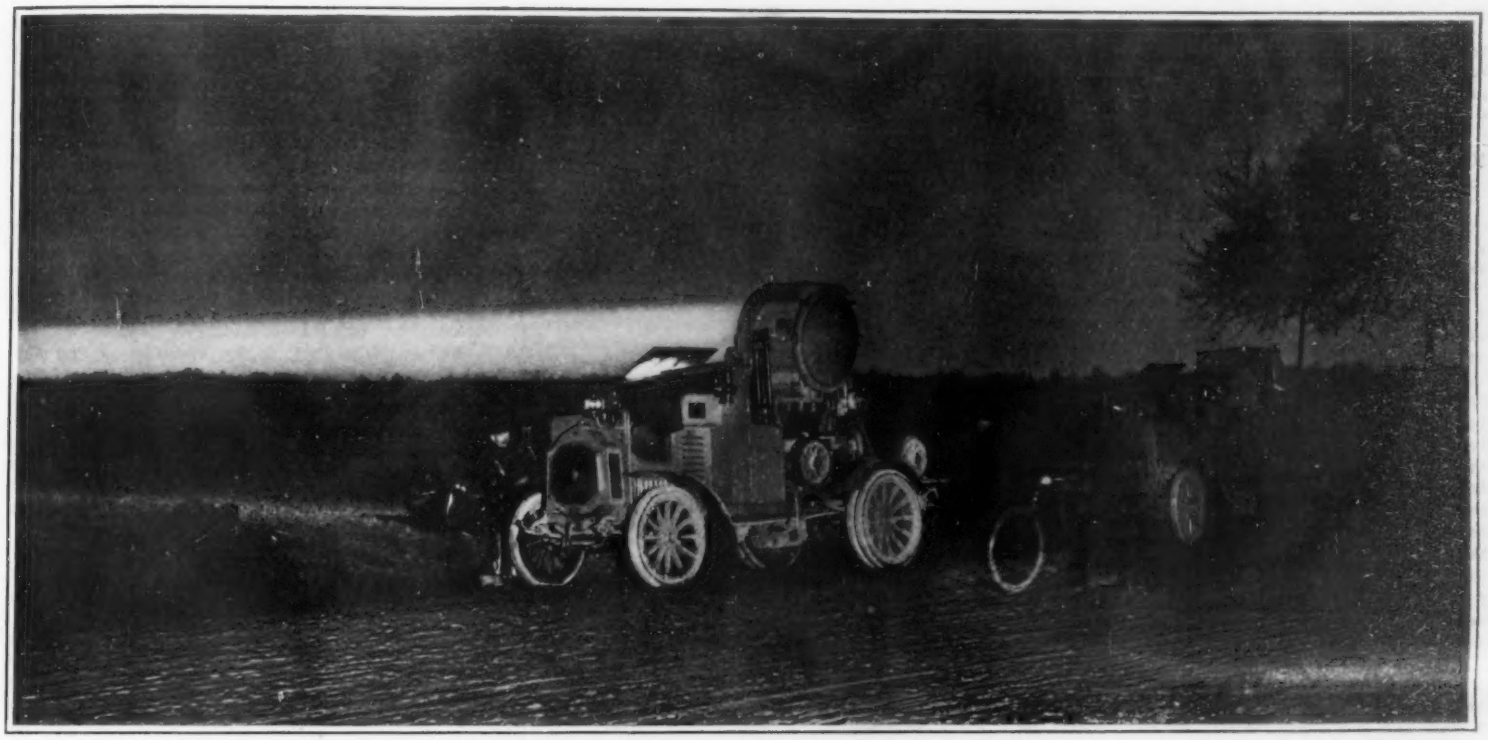


Fig. 1.– Automobile-mounted searchlight used in the French army.

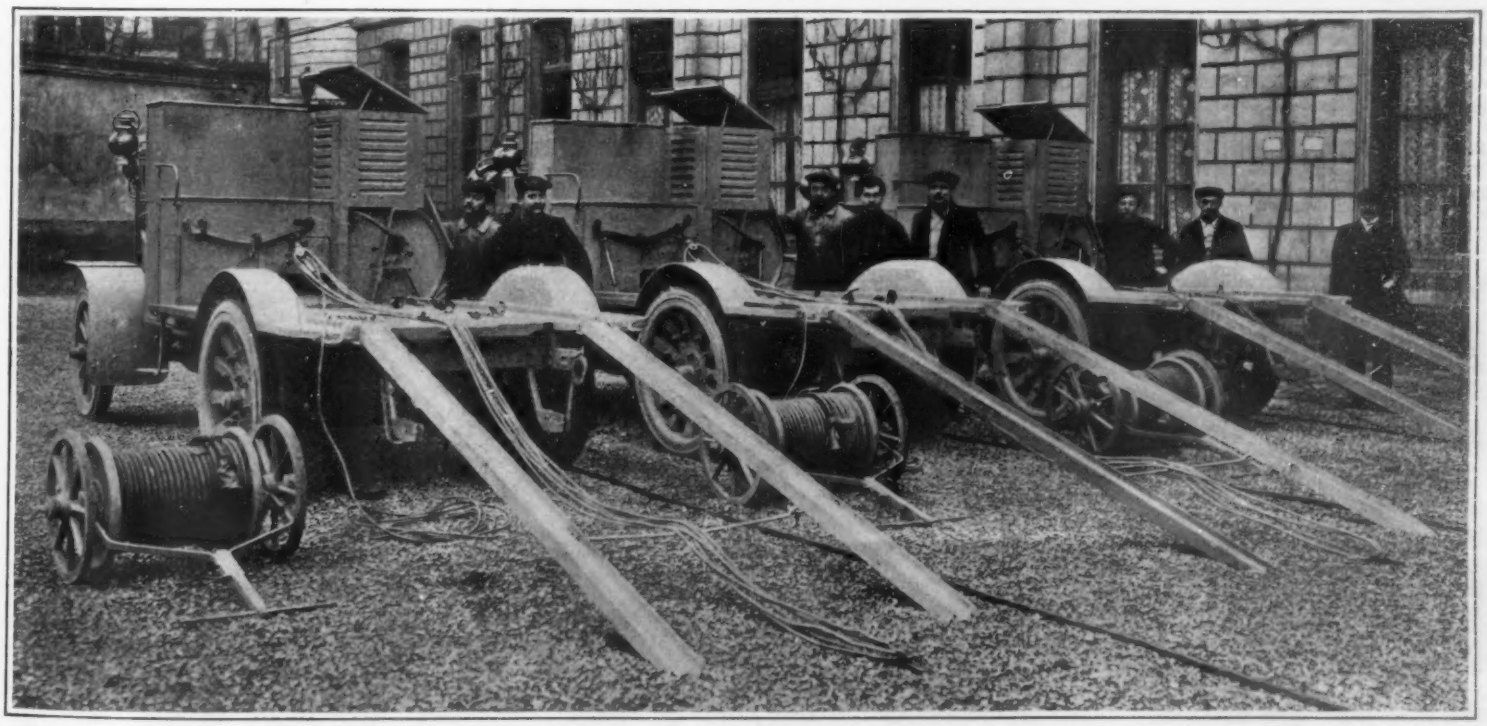


Fig. 2.—View showing loading and unloading facilities.

THE SEARCHLIGHT IN WAR

Presentation of the Scientific American Trophy

Speeches at the Aero Club of America's Banquet and Description of Curtiss's Work in Aviation

THE fifth annual banquet of the Aero Club of America, held the evening of March 29th, at the Hotel St. Regis, in New York, was notable chiefly on account of the presentation of the SCIENTIFIC AMERICAN Trophy, which, as already told in our columns, was won by Glenn H. Curtiss for the third time in three successive years on May 29th last. In addition to this presentation, Brigadier-General James Allen made a speech in which he told what the War Department is trying to accomplish in aviation.

We print below an abstract of the presentation speech of Mr. Charles A. Munn, president of Munn & Co., Inc., donors of the trophy and publishers of the SCIENTIFIC AMERICAN, and part of that of Gen. Allen as well.

PRESENTATION SPEECH.

"Mr. President, Mr. Toastmaster, and fellow members of the Aero Club:

"I feel sure that we all sincerely regret that it has not been possible for Mr. Curtiss to be present with us this evening and to receive in person the SCIENTIFIC AMERICAN Trophy.

"I think that this trophy may be regarded as a sort of milestone. Incidentally, it was given by the donors with the object of fostering the art of aerial navigation. In view of the development which has taken place in the art during the past three years, this trophy may properly be regarded as a milestone which has marked, year by year, the progress which has been achieved. When we hear, day after day, of extensive cross country flights of aeroplanes carrying eight, ten and twelve passengers, and when we have seen aeroplanes rise to a height of two miles above the surface of the earth, it is hard for us to realize that the minimum conditions of competition for the trophy during the year 1908 was only one kilometer, or a little over half a mile straightaway. Mr. Curtiss won the trophy for that year by covering this distance and a little more, making in all a flight of about one mile and a quarter.

"During the next year the distance was, with a good deal of trepidation, increased to a minimum of 25 kilometers in a closed circuit. Mr. Curtiss won the trophy for 1909 by covering this distance and making, all told, a flight of about 25 miles.

"The committee having charge of the arrangements decided to make the condition for 1910 a minimum flight of 50 miles across country. Upon the earnest solicitation, however, of a prominent official of the Aero Club, who had recently returned from Europe, the minimum distance was reduced from 50 to 40 miles.

"We all know how gallantly Mr. Curtiss won the cup for the third time by his memorable flight down the Hudson River from Albany to New York. He made the best long-distance record of the year in the first lap of this flight, by covering a distance of 71½ miles, between Albany and Poughkeepsie.

"We all have a feeling of endearment for the old

The Scientific American Trophy won by Glenn H. Curtiss.

historic river which passes by our city. Three names will always remain associated with the history of the river—that of Hudson, the explorer; that of Robert Fulton, the introducer of river navigation; and that of Glenn H. Curtiss, the birdman.

"At the request of the president of the club I beg to call the attention of the members to the most generous offer of Mr. Edwin Gould, of a prize of $15,000 for the most successful aeroplane provided with two or more motors arranged to be operated independently or in unison. I regret very much to see that Mr. Gould is not occupying the seat provided for him at the other end of the table, as I think some public recognition is due him for his splendid generosity in offering this prize, which is designed to prevent or minimize the fatal accidents which have been so prevalent of late.

"I believe that I am betraying no confidence in saying that Mr. Ryan has been in touch with Mr. Belmont with reference to holding these trials during some forthcoming meeting at Belmont Park, presumably about July 4th. An announcement in regard to the outcome of these plans will be given out later on.

"On behalf of the Aero Club of America, as custodians of the trophy, I have the honor to present to you, Mr. Post, the representative of Mr. Curtiss, the SCIENTIFIC AMERICAN Trophy, for permanent possession, and I feel sure that it will always be associated by the winner with that historic flight down the Hudson River, and it will furthermore have a special interest as being the first trophy ever offered in this country for aerial navigation."

Mr. Augustus Post, former secretary of the Aero Club, and the club's representative in all the attempts of Mr. Curtiss, received the trophy for Mr. Curtiss and made a fine speech of acceptance in which he told how America's noted experimenter had set out to win the cup at the start, and had kept constantly at work with this aim in view. How well he had succeeded, year after year, was told in a graphic way by Mr. Post.

GENERAL ALLEN'S SPEECH.

Following Mr. Post, Gen. Allen, in a few well-chosen words, told what the War Department is doing, as follows:

"This government has been accused of being slow to take up aviation as a part of the army service, but what is being done by the army authorities is not understood, or perhaps not known. One of the substantial evidences of the interest is the fact that the aeroplane is now in use on the Mexican border by the troops mobilized there, and is of unusual value in that part of the country because of the difficulty of travel.

"Only a few days ago one of our men went up in a machine and covered 106 miles in about two hours—a distance which it took two or three days to cover by wagon at one time. And he saw more of the country in those two hours than any of us had seen in years before. The army is now establishing an aviation course in Washington, along the east side of the Potomac River, and there it is the intention to let those

Presenting the Scientific American Trophy to Glenn H. Curtiss.

The guest table at the Aero Club dinner. Left to right—Charles A. Munn, president of Munn & Co., Inc., donors of the SCIENTIFIC AMERICAN Trophy and publishers of the SCIENTIFIC AMERICAN; Patrick Francis Murphy; Brigadier General James Allen, Signal Corps, U. S. A.; Allan A. Ryan, president of the club; John C. Montgomery, toastmaster; Hart O. Berg, European representative of the Wrights; Capt. W. I. Chambers, U. S. A.; Henry Sanderson, president Automobile Club of America; and Dave Hennen Morris.

THE FIFTH ANNUAL BANQUET OF THE AERO CLUB OF AMERICA

joining the aviation course have all the practice required to fit them for aerial flight. Another aviation field has been established at Fort Leavenworth, and some at other places throughout the country for similar purposes.

"One of the features receiving close attention is the development of flying machines from the viewpoint of stability and safety. The government now has about $100,000 to spend for machines, and will put it into the different types. As more money is appropriated the field will be extended.

"It is the ultimate intention, I believe, to teach aviation to several thousand army men, who will be ready at any time to go aloft in their machines during the mobilization of troops, no matter for what purpose, and it is believed that they will be an extraordinary adjunct to the efficiency of the army as a whole.

"But it is of great importance to the public to know that while the aviation grounds of the government will be primarily for army men, they will be open to the general public as well, so that any person having a flying machine can use it in these places freely and also get the benefit of the instruction of experts in flying. Their opportunities will be as great as those afforded to army men in the matter of study and practice."

CURTISS'S CAREER AND EXPERIMENTS.

Glenn H. Curtiss, the man who has done so much toward the scientific advancement and the practical development of aviation, was born in Hammondsport, N. Y., on the shore of Lake Keuka, on May 21st, 1878. When a boy he delivered newspapers in his home town and worked later as a messenger boy for one of the telegraph companies in Rochester, N. Y. Returning home, he established a newspaper route, and while delivering papers to his scattered customers became interested in self-propelled vehicles. Before he was twenty, Curtiss had built a motorcycle to carry him over his route. This machine was developed into a commercial product, young Curtiss paying the expense of his experiments by doing bicycle repairing and electrical work. The embryo motorcycle manufacturer also took up the motorcycle sport, winning many contests, including the American championship. Aiming for the speed championship of the world, he built a special machine, and in 1907 at Ormond Beach, Florida, he is said to have covered a measured mile in 26 2 5 seconds, which, if correct, stands as the fastest mile ever traveled by man.

From motorcycles to aeroplanes proved a short step. The lack of a suitable motor had been the greatest obstacle in the way of air navigation. Curtiss developed his small engine for use in dirigible balloons with successful results, and was soon supplying the power plants of practically every successful dirigible in America, including the airship sold to the United States Army by Capt. Baldwin.

Invited by Dr. Alexander Graham Bell to become a member of the Aerial Experiment Association, Curtiss was made director of experiments, and in this capacity designed his first heavier-than-air machine, the "June Bug." With the "June Bug" Curtiss won the first aviation prize offered in America—the SCIENTIFIC AMERICAN Trophy—by flying a mile and a half on July 4th, 1908. He made a number of flights prior to this, using other machines built under his direction by the association.

While teaching members of the Aeronautical Society to fly in Mineola, L. I., in the spring of 1909, Curtiss was urged by the Aero Club of America to represent this country in the first international race. With an aeroplane that had never been assembled until after he arrived on the field at Rheims, France, he defeated Blériot and other leading foreign aviators, becoming the first international champion. After Rheims, Curtiss was numbered among the world's greatest aviators. At Brescia, Italy, he duplicated his success at Rheims, and since then his movements in America have been indelibly impressed upon the minds of the public.

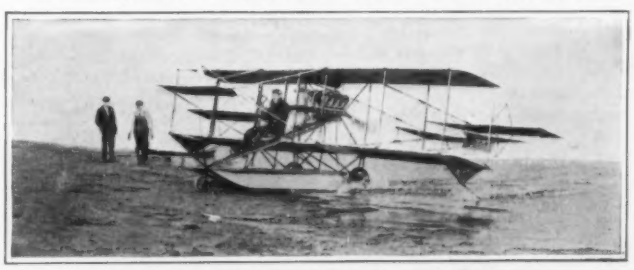
His flight down the Hudson River from Albany, N. Y., to New York city on May 29th, 1910—150 miles in 152 minutes—will go down in history. By covering the first half of this distance—71½ miles—in 1 hour and 23 minutes, or at the rate of 51¼ miles an hour, Curtiss won the SCIENTIFIC AMERICAN Trophy for the third and last time, and secured final possession of the cup. This is but one of the many triumphs he has accomplished, almost any one of which would have been sufficient to win him enduring fame. Among the most notable of those following the Hudson flight might be mentioned his "Fifty miles over the sea" flight at Atlantic City, N. J., in July, 1910; his trip over Lake Erie from Euclid Beach to Cedar Point, Ohio—64 miles—and return the following September, and his more recent flights from the surface of the water in the new machine developed by him, which alights on and flies from land or water equally well.

Photo by Levick.

Glenn H. Curtiss at the wheel of his biplane.

Three-quarter rear view of the Curtiss military biplane.

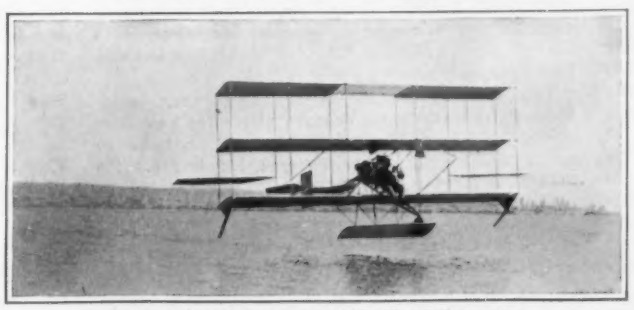
Note balancing planes at rear of uprights and movable horizontal rudders at rear of tail.



Curtiss biplane mounted on a float and wheels.

This machine is shown emerging from the water and running up on the beach.

Skimming the surface before rising into the air.



An experimental triplane flying above the water.

This picture shows very well the small size of float.

THE CURTISS MILITARY BIPLANE AND SOME OF HIS EXPERIMENTAL MACHINES

Aviation for military purposes has been given its greatest impetus by the experiments made by Curtiss or conducted under his direction, such as bomb dropping, target shooting, sending wireless from an aeroplane in flight, as well as the flights of Eugene Ely from the decks of two of Uncle Sam's battleships, upon one of which he successfully alighted. In furtherance of the military idea, Curtiss also volunteered to instruct aviators for the army and navy, and has graduated three army and one navy officer from his school at San Diego, Cal., without a cent's cost to the government.

During the past winter Mr. Curtiss has been experimenting at San Diego, with a view to perfecting a suitable float for starting from and alighting upon the water. He had already tried experiments in this direction a number of years ago upon the lake at his home at Hammondsport, N. Y., and profiting by the experiments of M. Fabre in France, he was not long in making similar floats with which he was able, on February 1st, to rise from the water with his biplane. He afterward simplified the floats to a single long, narrow, scow-shaped pontoon, which worked better than the hydroplane floats used at first. He found experimenting on the water was preferable to experimenting on land, and he made numerous changes, such as placing the motor in front and the aviator's seat behind the main planes, and adding a third surface above the biplane, thus converting it into a triplane. One of the most interesting feats he is said to have performed was flying with but one aileron, or balancing plane, on his machine. In view of the patent litigation he has had with the Wright brothers, this should prove valuable in behalf of Mr. Curtiss's defense.

Finally, after all these other experiments, Curtiss early last month fitted wheels to his biplane in addition to the float, and rose from the water or from the land and alighted upon either at will. One of our photographs shows his machine coming out of the water and running up on the shore. Thus he succeeded in perfecting the machine so that it is now a true mechanical water fowl.

Only a couple of weeks ago, after having instructed four officers of the army and navy in flying at San Diego, Curtiss delivered to the War Department at Washington his first military biplane, a photograph of which is also reproduced on this page. This machine has several new points of interest, such as the placing of the ailerons at the rear of the machine instead of at the front, and the tail, the movable rear ends of the two triangular surfaces of which act in conjunction with the front rudder to steer the machine in a vertical plane. This biplane is very strongly built, and is capable of carrying two men and 300 pounds extra weight. It has a spread of 32 feet, an over-all length of 29 feet, and its total supporting surface is 320 square feet; the weight complete is 700 pounds. In making the acceptance flight Mr. McCurdy made two magnificent flights of 10 and 8 minutes' duration above the Potomac at Washington. The machine has been sent to San Antonio, Texas, where the officers will experiment with it. Mr. Curtiss himself will come East the middle of this month, and will conduct further experiments in the neighborhood of Annapolis. In all probability he will devote much of his time in the near future to perfecting the aeroplane for naval use.

Copal varnish (according to Heeren).—Dissolve 60 parts of West Indian copal in 30 parts of highest per cent spirits, 10 parts ether, 40 parts oil of turpentine, by gently heating. This succeeds only with the varieties of copal that in the above named solvents are not merely softened but actually dissolved—the copal must therefore be tested first as to its solubility.

Old Coins and Ancient Bankers

The Origin of Our Modern Methods of Commerce

By Walter H. Woodward

IT is to Lydia that Europe owes the invention of coinage. In all times and in all countries, the privilege of coining has been allowed the sovereign. Cresus, of Lydia, was the first monarch to introduce a bimetallic system of coinage—gold and silver in the proportion of about three to four. This was some time between 560 and 546 B. C. Darius, of Persia, is said to have later adopted this idea also.

At a very early age the ancients found it necessary to discover some definite medium of exchange to take the place of the inconvenient method of bartering—the most primitive means of carrying on trade. Metal was chosen doubtless by reason of its durability, and in the case of gold and silver, by reason of their intrinsic value. Silver and brass were first used, particularly in Greece, from a lack of sufficient gold. Later, however, this deficiency was overcome in a manner to be described farther on.

The less liable a metal is to change in value, the better it is suited for a standard.

The first method of using precious metal as a medium of exchange was impracticable and inconvenient. It was simply weighed and exchanged, in full, for commodities of various sorts. Soon, as commercial transactions increased and became more complicated, it was found necessary to divide the mass into units of various weights, which took the form of rough coins. To this day there is one surviving relic (in name only) of this first system of payment by weight. It is the word *pound*. This division proved unsatisfactory also, since no two merchants were likely to have split their store of silver into pieces of equal weight. Their units could not be taken as a standard, since a piece of weighed metal becomes a coin only when it is stamped by the State, and is thus guaranteed to have its professed weight and purity.

The Greeks first issued real coin some time during the seventh century B. C. By the fourth century the entire civilized world used money. It is supposed that the priests played an important part in the introduction of money, for it is highly characteristic of them that their coins were from the start marked by religious association. So ancient coins in a great measure confirm history and have been, and in the years of discovery yet to come will doubtless continue to be, of the greatest help to historians.

In addition to illustrating events of history, these coins have also a direct and valuable bearing on the religious beliefs of the nations and tribes by which they were issued. The mythology of the Greeks has not been recorded by them in sacred books to any extent, nor handed down to later generations by a faithful and studious priesthood. Their mythology ran on unchecked, and having grown out of the beliefs of scores of various tribes, reaches us in a condition which scarcely admits of sytematizing. The Greek coins up to the death of Alexander bear only sacred subjects. Every coin issued bears a reference to some deity. Coins of Miletus, for instance, bear a lion; those of Eretria shows a cow and sucking calf; those of Cyzicus show a tunny-fish, etc. All these were symbols of the goddesses. The coins issued under the empire bear, as a rule, the imperial portrait on one side, and on the other a sacred emblem. The whole, then, affords us invaluable assistance in reconstructing Greek mythology.

Ancient coins are of almost equal value to the geographer as to the historian.

Then too the art of sculpture, of which coin engraving is an offspring, receives great illustration from a careful study of these coins. The memory of lost statues is preserved for us, and, particularly in the case of the Greek coins, we are afforded an example of that skill by which her sculptors attained such renown.

The history of Greece is one of a people continually torn by civil dissension. Their story is one of war and strife, forever between themselves, and in later years with outsiders. War is an expensive thing in more senses than one, though we have need to take note here of pecuniary costs alone. As the various States were jealous and always at odds, so were men, and as a consequence the religious temple was resorted to as a depository for the safekeeping of precious metals and jewels. These religious institutions played no unimportant part in the development of earlier Greek commerce. They held vast sums of gold plate, and this, together with fortunes of their own, derived from votive offerings, they employed productively for their own use. They loaned money at a high rate of interest, and this custom very likely suggested to others the idea of doing likewise. Pasion was probably the first to do this. He founded a house at Athens, operating with a capital of fifty talents. He established for himself first-rate credit at all centers of Greek commerce. In this way business could be transacted by the exchange of a sort of letter of credit in place of payment in coin.

The introduction of this system despite its small scale shows the growth of commercial activity. Money was now more plentiful, and all prices higher than ever before. This was due in a measure to the amount of precious metals, chiefly gold, which had been brought into circulation. War upon war led to the gradual coinage of the treasures which had for years been accumulating in the temples, and this new "banking" system put on the market money which would otherwise have been hoarded. The interest rate was high. Twelve per cent was paid for the loan of money. This fact is significant. It shows the thriving condition of industries. Capital was evidently in demand. With a fortune of fifty talents (less than $50,000) there would be yielded an income of $6,000. That sum of course then possessed far greater purchasing power than does an equivalent weight of gold to-day.

It might be well to say a word here concerning the origin of the term *bank*. Some authorities have it that its origin is found in the Italian word *banco*, a bench used by money changers in the market place. I am inclined, however, to favor the claim of other authorities, who maintain that the term takes its origin from the old German word *Banck*—a pile, mound, heap, as of precious material.

Greek bankers (*trapezitæ*) maintained their stands in the Agora, and combined in their vocation a number of other businesses. They changed money, bought foreign money at discount, furnished gold for export, loaned money to merchants on security of ships and their cargoes, and received sums on deposit for which they paid interest. They later on often acted as pawnbrokers, accepting gold plate and jewels, and other personal property.

We have no evidence that any of these ancient banks and bankers were ever guaranteed by the State, and very likely they were not. One exception may have existed, however, if we are to credit Aristotle, in the case of Byzantium.

In Rome, bankers are known to have existed as early as 309 B. C., their functions being practically identical with those of Greece. We have a trifle more reliable information concerning these Roman bankers than we have of the Grecian. Their various branches of doing business seem to have been as follows:

Their *Permutatio*, or exchange of foreign coin for Roman currency. For this they charged a commission or exchange. Subsequently, when the Romans acquainted themselves with the Greek method of bills of exchange, they received money which was to be paid at Athens, for instance, and drew a draft of exchange upon some Athenian banker with whom they ran an account.

Their *Depositum*, or keeping of sums of money for other persons. Cash might be deposited merely for safekeeping, in which case the banker (*Argentarium*) paid no interest. When a payment was to be made, the owner was required to draw a check, as in modern times. But the deposit might have been made upon the stipulation that interest be paid, in which event the transaction was called *Creditum*. The banker could then employ this money in his own interests.

In the event of failure of a bank, the law enacted that the claims of the *depositarii* should be satisfied before those of creditors who had money deposited to their credit at interest. The *Argentarii* never delivered money to anyone except upon receipt of a check, and the payment was made in cash, or if the person who received it kept an account with the same banker, the sum was credited to his account.

Of all receipts and expenditures these bankers kept an accurate account in books called *Codices*, and we have every reason to believe that they were familiar with double entry bookkeeping. Thus the *Argentarii* carried on a business almost identical with that of the modern bank. They combined with their regular banking business other avocations of a kindred nature. They often acted as agents at private sales and auctions. They acted as brokers, too, in the modern sense, and frequently undertook to sell entire estates as inheritances.

For many years the ancients maintained that charging interest partook of the nature of usury, and men of this profession did not enjoy the very highest reputation. After a time, though not escaping reproach, the higher class of bankers maintained a good name and enjoyed a reputation for honesty and ability. Their credit in all parts of the commercial world enabled them to raise on short notice large sums of money in foreign cities. Much confidence was finally placed in them, business often being transacted without witnesses, so they became in time a sort of unofficial notaries public.

The Le Verrier Centenary

LE VERRIER was born on March 11th, 1811, at St. Lo, in the Department of La Manche, France. This is the year, therefore, in which the entire scientific world celebrates the centenary of his birth. Undoubtedly he was one of the greatest mathematicians that ever lived. College undergraduates who fail in mathematics may find some consolation in the fact that despite his special aptitude, he failed to pass his examination at the Polytechnic in 1830. After graduating he was about to become assistant to Gay-Lussac, when he was offered the assistant professorship of astronomy at the Polytechnic School, which post he accepted. Thus he was fairly launched on an astronomical career remarkable for its brilliancy. His first astronomical monograph bore the title, "Memoire de Mecanique Celeste," and was published in 1839.

Le Verrier, of course, is best known for his mathematical discovery of Neptune. Not only was a new planet added to the solar system, but the immensity of stellar distances was driven home. It was on August 31st, 1846, that Le Verrier announced to the Academy of Sciences the theoretical position of a planet which caused the perturbations of Uranus, perturbations which were first discussed by the French astronomer Bouvard, and which for two decades and more were a source of much mathematical comment among astronomers. A few weeks after the announcement of the Academy of Sciences, Galle, in compliance with Le Verrier's request, directed his telescope to that portion of the sky indicated by Le Verrier, and found the star which we now call Neptune.

This brilliant success inspired Le Verrier to investigate the movements of every planet from the first to the last, from Mercury to Neptune, an immense labor, which completely shattered his health. He died on September 23rd, 1877.

The Current Supplement

THE opening article of the current SUPPLEMENT, No. 1840, describes two new breakwaters on the west coast of Jutland.—Technical chemistry has contributed a very important share in the successful development of aerial navigation. What chemistry has done for ballooning, for example, is well told by Mr. A. Sander, in an article entitled "The Preparation of Gas for Balloons."—The effect of radium on the higher animals is discussed in the light of Prof. London's researches.—One of the most important articles in the current SUPPLEMENT is Mr. Walter V. Turner's paper entitled "The Air Brake as Related to Progress in Locomotion."—The question of efficiency and economy in the management of industrial enterprises, as revealed by Mr. Harrington Emerson, is presented in a summary of the paper read by Mr. Emerson before Harvard University.—Mr. W. C. Phalen's paper on "Potash Salts" is concluded.—Some interesting new French toys of a mechanical nature are described and illustrated.—Mr. S. S. Hough discourses on the aims of astronomy of precision.

The Loss of Oil Entailed by Burning Wells

ACCORDING to the *American Machinist*, it has been estimated that there are lost annually more than a million and a half barrels of oil by the burning of oil wells.

What do You Think of the Scientific American?

Some Answers to a Question which We Put to Our Readers a Few Weeks Ago

THE full-page advertisement which we published, in which we invited our readers to express themselves frankly about the SCIENTIFIC AMERICAN, *has brought forth an overwhelming response. Some of the letters have been highly eulogistic; some have indicated the very personal views of their writers; and some have been really helpful in pointing out what we must still do to make the* SCIENTIFIC AMERICAN *an even more popular weekly than it was before. The following letters are selected and published largely for the purpose of stimulating more replies.*

The Editor wants you to take the same personal interest in the SCIENTIFIC AMERICAN *that he takes in it himself. After all, it is your paper as much as his. You pay for it, and you have a right to tell him whether or not you are getting what you expect out of its pages. If you have not already communicated with the Editor, do so. Tell him whether or not you agree with the readers whose letters appear on this page; tell him just what the* SCIENTIFIC AMERICAN *means to you, where it helps you, and where it fails to help you.*

From Brazil

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to congratulate you on the appearance of the greater SCIENTIFIC AMERICAN. A beautiful number—in typography, engravings, and matter. I hope your effort to better the already good, will meet with a generous recompense.

Guarapuava, Parana, Brazil. REV. J. B. KOLB.

A Word of Appreciation

To the Editor of the SCIENTIFIC AMERICAN:

I am very much pleased to note that our welcome Thursday visitor, the SCIENTIFIC AMERICAN, has been increased to twenty-four pages; also to note the handsome mid-month numbers, which are, as usual, brimming full of interest. This adds another large step to the great superiority your magazine has over any other magazine published anywhere in the world.

I am a subscriber to the paper, my father is a mechanical engineer, and since I first learned how to read, I don't think there has been a single week when the SCIENTIFIC AMERICAN did not find its way to our library table. It is the most comprehensive, at the same time intensive, and valuable and most vitally interesting magazine that is published to-day. It is the concrete expression of the world's progress in that most interesting field, science.

We have always felt this way about the SCIENTIFIC AMERICAN, and as this is the first time I have had occasion to address you, I take pleasure in saying it for our whole family.

Atlanta, Ga. T. C. BUTLER, JR.

One Interested in Static Electricity

To the Editor of the SCIENTIFIC AMERICAN:

Your well-meant inquiry as to taste of your subscribers in articles most favored called my attention. I personally am very much interested in the study of atmospheric, magnetic, and static electric effects of this planet in first place, and then its, or their mutual effects in the solar system.

Very respectfully yours,

Minas Nuevas, Mexico. C. R. MEYER.

No Interest in Astronomy

To the Editor of the SCIENTIFIC AMERICAN:

I will have to confess that I do not care for the subject of astronomy at all. I know it is a wonderful study, but it has no charms for me. I have nothing to say about dropping the patent list from the SUPPLEMENT, for I do not take that paper.

Pittsburg, Kans. JAMES TOMLINSON.

More Archaeology and Anthropology Wanted

To the Editor of the SCIENTIFIC AMERICAN:

I have been a reader of the SCIENTIFIC AMERICAN for some years, and consider it one of the most important as well as interesting of our periodicals. A criticism I would make, however, is that the non-mechanical phases of scientific progress seem to be slighted. I refer particularly to archæology and anthropology, the former of which is continually making immense advances, with which it is difficult for the average reader to keep at all in touch. At least one generous article each month could well be given to such subjects. Some of the more purely technical matters could be confined to the SUPPLEMENT, leaving the SCIENTIFIC AMERICAN for the broader phases of knowledge, where mighty vistas of time and space offer the reader an escape from the details of manufacturing and transporting the necessaries and luxuries of our physical life.

Washington, D. C. PAUL R. BIRGE.

Some Helpful Suggestions.

To the Editor of the SCIENTIFIC AMERICAN:

I like the SCIENTIFIC AMERICAN real well, and I am very thankful for such a truthful, reliable publication. The topics which especially delight me are those relating to natural history—birds, animals, insects, plants. Then astronomy and your editorials. "Science in the Current Periodicals," is very timely.

The column of science paragraphs is for the common and general reader, and is a home-like department. More of this class would be an advance.

As your paper is studied by thousands of mechanics who live on farms, the subject of improved methods of farming, and the mission of plants, chemistry of soils, would surely be quite agreeable reading for the masses, as the land is now advancing to the first place in material concerns of our people.

"The Handy Man's Workshop" is a useful edifice. I would like to visit the editor. I invite him to come and visit us real often.

I write for the agricultural press, and other publications; am an amateur student of plants, birds, animals, geology, and am an Audubon follower. Perhaps a column in the SCIENTIFIC AMERICAN on mercy to animals would be a missionary for good.

Alexandria, Mo. JASPER BLINES.

One-third Better

To the Editor of the SCIENTIFIC AMERICAN:

In response to your article in the SCIENTIFIC AMERICAN to your subscribers, as to how they liked the way the SCIENTIFIC AMERICAN is conducted, I wish to say that it is conducted splendidly.

Your weekly articles on aviation are very instructive. Your monthly magazine numbers are a great improvement over the old SCIENTIFIC AMERICAN. Your new department "Science in the Current Periodicals" is a very valuable addition. The removing of the patent list, and putting reading matter in that space, was very wise, for the reading matter is, I think, more valuable than the patent list.

I may say in a few words that I think the new SCIENTIFIC AMERICAN is at least one-third more valuable and instructive than before the present change.

Frederick, Md. ALFRED G. ZIMMERMAN.

Mr. Spears Wants Medicine

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the request for suggestions regarding the amount of space devoted to various matters in the SCIENTIFIC AMERICAN, let me say, first, that I am so well satisfied with the paper as it is, that if I were to become so poor I could afford but one periodical, I should hold fast to this. In fact, I have been to the expense of buying a complete file of the paper, all the volumes, except only the rare and very high-priced Volume I. I did this because I thus secured a trustworthy history of the progress in science during more than half a century past.

So you will believe, I hope, that if I offer a suggestion, I do it with full confidence that you know much better than anyone else what such a periodical should contain. As it seems to me, however, you ought to devote a little more space to the development of medicine—the new discoveries made through the study of human diseases and of the means for preventing and curing them. Thus two of the monthly magazines that I have been reading recently gave detailed accounts of the evolution and uses of that curious remedy named 606. The account in the SCIENTIFIC AMERICAN was a mere reference, and by comparison very disappointing.

You will say, perhaps, that the magazines exaggerated the story, and that much work is yet to be done with the remedy before it can be classed as a scientific achievement. Granting this, may I not suggest that all the steps made in developing such a thing, including the mistakes made, are, or ought to be, of the very greatest interest to every intelligent reader?

Let me emphasize the assertion that such work ought to be of intense interest. That many people do lack interest is an astounding fact. Why, we are in a state of civilization where our Congress devotes nearly two hundred and fifty millions a year to the development of the arts of taking human life, and leaves such research work as is done at the Rockefeller Institute to be supported by one much-abused man! And that is not all. We are removed from a state of barbarism, where an adequate food supply was to be secured only by those having exaggerated greed—we are removed from that state by so narrow a space of time, that when one would enlist the public in a campaign, say, against tuberculosis, he must point out, first of all, the *financial* loss which the community suffers when a man dies from the insidious disease. Consider this well. We know that the victim of the disease faces death for months as surely as one condemned for crime does, we know that he is killed by inches, and we know that his relatives suffer the torments of the damned as they see him go, but before we will lift a hand to wipe away the plague, someone must tell us that his death means the loss of a producer worth five thousand dollars!

It is clear that even intelligent people are chiefly interested in reading the stories that tell how some one has made, or is to make, some discovery by which he will grow two blades of grass where he grew but one before. The production of grass is our test of interesting progress.

I concede that if you will, newspaper fashon, give people only what the majority want, you will omit most of the accounts of advances in medicine. But I beg you to remember that your work is educational to an extent not enjoyed by many, and that the appetite for what we read grows with amount of material assimilated. We strove to grasp the Fourth Dimension when you gave space to it, and in like manner reading about Remedy 606 (or call it Remedy 707, which it may be when at last it is the perfect thing) will create a *working, forwarding* interest in the struggle with what seems now to be unconquerable diseases. For the sake of those who now stand helpless beside the beds of the dying join, by the method I have suggested, in the work of the few who are trying to raise our civilization to a level where the arts of healing will have at least as much consideration as the arts of destroying human life.

Northwood, N. Y. JOHN R. SPEARS.

[Author of "The History of Our Navy from Its Origin to the Present Day."]

A Clergyman Approves

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of your invitation in the SCIENTIFIC AMERICAN for the friends of the paper to make such kindly suggestions as they may wish, I venture to suggest one or two thoughts.

First. I wish to most heartily indorse the policy and successful handling of the material you give us from week to week—especially since you have enlarged and changed the plans. It is most helpful, and it gives me pleasure every few days to refer to its value, etc.

Second. While I do not feel that the management has materially erred in any essential, still it does appear to me that there are occasionally articles that might be classed under "Novelty," that are too trifling to merit a place in so good a paper. I do not object so much to their publication, if they really fill a place for someone else, as I do feel that I would like to see more along the other lines.

Third. I most heartily approve of the idea of placing the patent matter in the SUPPLEMENT.

Fourth. While I am a layman in science, I feel a general interest in everything of a scientific nature, and appreciate the generous space allowed to the several topics and sciences. Give us also more short scientific items and new notes, such as you give us one column of under "Science."

Fifth. I want to most heartily approve of the most generous amount of space given to astronomy. You have given such a liberal amount of space to this science, that no one has any right to say that it is not receiving proper recognition. The monthly notes and map are better than I have seen in any amateur astronomical journal. At my Chautauquas, where I lecture and conduct classes in astronomy, in my correspondence courses in this subject, and in my occasional lectures before high schools, normal schools, and general popular audiences, I always refer to this most helpful material at their disposal. I am constantly consulted through the mails by amateurs all over the country, and I find there is a great desire for material of this kind. Now we can not rightly demand more, but I do feel that if you feel disposed to give us more space, it would be helpful. I do not refer so much to more special articles—although we will appreciate all you can give us—but I mean such a page of monthly amateur notes in astronomy as I recently wrote you about—practical notes to assist finding the planets, asteroids, etc., and a calling attention to all important events in the astronomical calendar. I should like to see one page, or even half a page if a full page could not be spared, filled with this kind of material. Soon an Amateur Astronomical Association of the United States and Canada will be regularly organized. Already a part of the membership is in connection with each other. When that definite and formal organization is perfected, I believe I can assure enough interest in further astronomical material to make it worth your while to gradually add more along this line.

Before closing this reference to astronomy, I want to thank you for your generous spirit in publishing practically all articles I have furnished you along this line. However, I do not wish to embarass you by furnishing more than you wish or can use, and a friendly refusal any time will be cordially received.

Realizing that your task is indeed more difficult than the many thousands of readers appreciate, I have a most hearty appreciation for the high grade of work you are doing, and never suggest any negative criticisms to others.

Edgerton, Wis. REV. RUEL W. ROBERTS.

From an Electrical Contractor

To the Editor of the SCIENTIFIC AMERICAN:

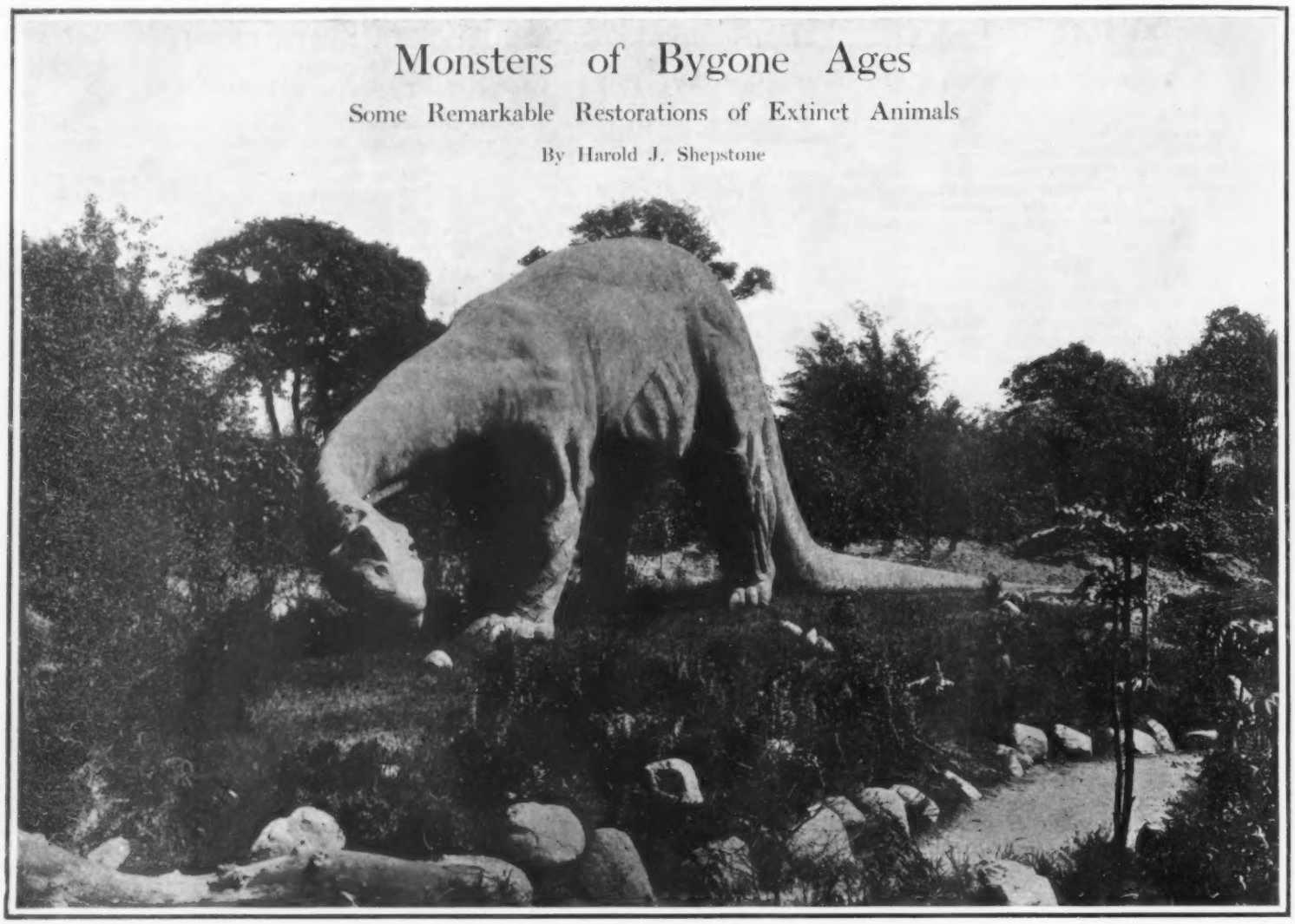
In reply to your editorial of March 11th, would say that I have been a reader of the SCIENTIFIC AMERICAN since 1886, and unhesitatingly state that I have received great knowledge from its contents. In my estimation, the weekly patent issue should be published, its many illustrations giving new ideas to the thinker.

Mt Carmel, Ill, PAUL M. JANKE,
Electrical Contractor.

Monsters of Bygone Ages

Some Remarkable Restorations of Extinct Animals

By Harold J. Shepstone



Diplodocus—the giant of saurians, measuring some sixty-six feet in length.

AT Mr. Carl Hagenbeck's famous animal park at Stellingen, near Hamburg, there have been erected life-size representations of the great monsters that inhabited this earth millions of years ago. The idea of the proprietor in building these strange beasts is to present to the public view a faithful and accurate picture, so far as science can tell, of the weird creatures that roamed over this globe in the distant past.

The work has been carried out by Mr. J. Pallenberg, a well-known German animal sculptor. These strange beasts of the past have been built up of cement and rightly occupy a portion of the grounds to themselves. In all, some thirty have been constructed around the shores of a delightful little lake some three acres in extent. The animals are depicted standing by the water's edge amid the shrubs and trees, while in the lake itself are shown huge crocodiles and other aquatic types. Additional realism has been obtained by presenting a few of the animals in the act of battling with specimens of their kind.

The first animal to be erected was the iguanodon, a great herbivorous dinosaur. That this creature habitually walked on its hind legs has been proved beyond doubt by tracks found in various parts of Europe. In the year 1898 no fewer than twenty-five specimens of this huge creature were brought to light from the colliery of Bernissart in Belgium, a discovery quite unique in its kind. Every bone of the creature's skeleton has now been cast in plaster of Paris, so that duplicates can be supplied to museums. This dinosaur had a most remarkable dagger-like thumb, so big and pointed in shape that at one time, when discovered by itself in England, it was considered to be the iguanodon's horn. Some popular works on geology still continue to reproduce an old restoration with this strange horn on the creature's nose! The specimen in cement at Stellingen towers some twenty-five feet into the air, making the trees around look rather small. The thumb of the monster measures some eighteen inches in length.

In the construction of these restorations every care has been taken to render them accurate. Before the sculptor commenced operations at the gardens he spent twelve months in preparatory work. He visited all the leading museums in Europe, consulted with leading naturalists and made extensive drawings and sketches of the bones which have been brought to light by the fossil hunter. He admitted to me that he had obtained a great deal of help from the authorities of the American Museum of Natural History in New York, who supplied him with valuable photographs and drawings as well as measurements. I noticed in his office, too, copies of the SCIENTIFIC AMERICAN containing articles and illustrations on the subject. Before work was actually commenced in the park, models were built in clay, casts taken of them, and these were submitted to leading authorities for opinion. When it was found that they differed the models were re-made and submitted again until they met with the desired approval. There are several representations of the dinosaurs, or "terrible lizards." These creatures lived upon this globe some five to ten million years ago. They all possessed four limbs, while a few, like the iguanodon, walked on their hind legs. The majority, however, strolled about on four feet, like the quadruped of today, every stride they took resulting in footprints one square yard in area. Indeed, these were the biggest terrestrial and semi-aquatic

(Continued on page 364.)

Tyrannosaurus—one of the carnivorous forms.

Dactylosaurus—a flying type of saurian.

RESTORATIONS OF PREHISTORIC ANIMALS

Triceratops—One of the most fantastic forms that have come down to us in the fossil records of the earth's history.

A RESTORATION OF AN EXTINCT ANIMAL AMID NATURAL SURROUNDINGS

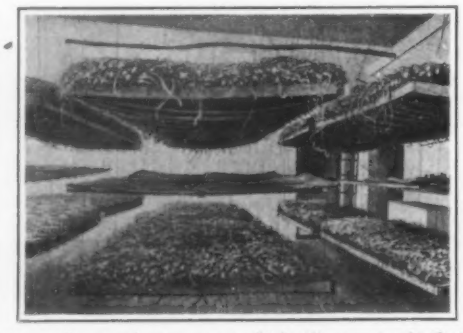
Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

Scientific Sericulture

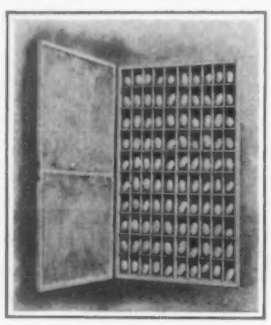
THE rearing of silkworms was at one time an important source of wealth in many districts of southern France, but the industry has been almost destroyed by the ravages of parasitic diseases, and only a few small and not very flourishing establishments are now in existence.

In view of the fact that efficacious methods of checking the scourge have been developed from the memorable researches of Pasteur, the decadence of French sericulture is very remarkable, especially as French silk manufacturers are still very prosperous and cocoons are imported in large quantities from the European countries. French silkworms are not peculiarly susceptible to disease. The superiority of the foreign silk culturists is due solely to their more intelligent practice of the scientific methods of sericulture which were developed in France by French scientists. It is not sufficient to give the silkworm breeder a microscope and show him how to use it. In order to follow Pasteur's method intelligently and apply it to every detail of practice, it is necessary to create an organization for the direction and control of the various operations of sericulture. The importance of details and secondary questions cannot be shown more effectively than by describing an establishment, the only one of its kind in the world, which private initiative, aided by public funds, has created in the Austrian Tyrol, where sericulture is now in a very flourishing condition. The description which follows is adapted from a recent issue of *La Nature*.



Three systems of arranging trays on which silkworms spin their cocoons.

Microscopic examination of moths.



A box of cocoons.

A cocoon storehouse.

SCIENCE TO THE AID OF SILKWORM CULTURE

In 1882 the Bacological Institute of Trent was founded by a provincial agricultural society for the purpose of making Tyrolese silk culturists independent of imported "seed," or silkworm eggs, improving native breeds, giving technical instruction and teaching good methods of sericulture. Since 1894 the institute has occupied buildings specially constructed for its use with the aid of funds contributed by the society and the municipal and general governments, but these buildings are now inadequate, and new ones are contemplated.

The work of the institute is of three kinds: The production of sound eggs of good breeds of silkworms, technical instruction, and experiments in selection and in methods of sericulture. Of these three functions the production of eggs is by far the most important, because of the care required and the large number of eggs which the institute furnishes to silk culturists. About 25,000 ounces of eggs are kept through the winter in cold storage in a current of dry air. In April the eggs are shipped to domestic and foreign purchasers, to whom they are sold for about one third of the market price of inferior eggs, as the institute is operated with economy and seeks no profit. Each ounce of eggs yields about 160 pounds of cocoons of very high quality. Some of the eggs are retained for distribution among 600 breeding stations scattered through the district, so that each variety of silkworm finds the conditions most favorable for its development. These stations are supplied with everything required for new methods of culture which have been tested at the institute, as well as for the routine usually followed in the Tyrol. The accompanying illustrations of different arrangements of twigs on which the silkworms climb and spin their cocoons give an idea of the variety of methods employed. These stations are directed by former pupils of the institute, and they form secondary centers of instruction. The stations are very successful, as the institute pays high prices for cocoons produced by approved methods.

When the cocoons are received at the institute the female cocoons, which are heavier, are separated from the males, and all cocoons of abnormal appearance are rejected. A few cocoons are brought rapidly to maturity in incubators heated to about 90 deg. F., and the consignment is not accepted unless healthy moths emerge from the sample cocoons. The cocoons are then placed singly in compartments or boxes marked with the names of the breeds and stations, or are isolated in other ways, and are allowed to develop normally.

At the season when the moths emerge 300 women are employed, day and night, in imprisoning the moths in cells of gauze or waxed paper, which are mounted on frames and suspended from the ceiling. The empty cocoons are stored in large rooms where the few belated moths that appear are killed to prevent all danger of contamination. The mass of cocoons goes ultimately to factories of "schappe" (inferior silk spun from fibers which have been carded and not reeled from the cocoon).

The imprisoned moths die after they have laid their eggs. The cells are then opened, and the dead moths are examined with the microscope according to rules deduced from Pasteur's celebrated research. There are about three million cells, containing 25,000 ounces of eggs, and the work of examination occupies 150 women, 40 of whom are microscopists, during four months. The work is highly specialized. Some women do nothing except opening the cells, others remove each moth and crush it into a paste, which is carefully examined with the microscope. The eggs produced by the healthy moths are collected from the cells, washed with many precautions by expert operators, and spread out to dry on frames covered with linen cloth.

In addition to this industrial and commercial work of producing and selling silkworm eggs, the institute endeavors to stimulate the progress of sericulture in general. For example, it has constructed an oven in which the pupæ contained in 100 pounds of cocoons can be killed in five minutes, and which is rented to silk culturists. There is also a drying chamber in which three tons of cocoons can be dried daily.

Judicious selection of breeds and strains is favored by the work of a laboratory in which silk reeled and spun from cocoons of different varieties is weighed, measured and tested for strength and elasticity. The institute maintains courses of lectures for its operatives and for girls sent by the agricultural societies and communal syndicates. These pupils, from 50 to 100 in number, not only take notes of the lectures, but receive practical instruction in the use of the microscope and other operations of sericulture. The pupils remain in correspondence with the institute, which is thus brought into intimate relations with all silk-raising districts and is enabled to give useful advice wherever and whenever it is needed. All of the pupils receive free board and lodging during their winter sojourn at the institute.

Finally classes are organized in various centers of sericulture by members of the technical staff of the institute. In this way instruction is given to many persons who are unable or unwilling to attend the courses given in Trent, the education of former pupils is continued, and all persons interested in the subject are kept informed of the latest advances in sericulture.

The long period of prosperity which silk culture formerly enjoyed in France proves that the climate is well adapted to the cultivation of the mulberry and the propagation of silkworms, and that the present decadence of the industry is due to the want of rational application of scientific principles. There are a few French sericultural experiment stations, but they are insufficiently endowed and are too much afraid of publicity, initiative and responsibility to take official part in any commercial transaction. Hence the French stations have no direct and close connection with the silk growers and give them little aid. Without exactly copying the Tyrolese model, which might not prove equally successful in a different environment, it would be well for the French stations to adopt the most important features of the Bacological Institute of Trent. The need is urgent, for the production of raw silk in France is diminishing so rapidly that the industry is threatened with extinction within a few years.

A Suggested Reorganization of the German University System

THE German universities have hitherto been exempted from the criticisms and the reformatory projects which in recent years have been directed against the general educational system of Germany. For many years these universities have been attended by great numbers of foreign students who, though unsparing critics of German political and social conditions, have been unanimous in praise of the universities. In the opinion of the eminent German chemist, Prof. Wilhelm Ostwald, who discusses the subject in a recent issue of *Die Umschau*, this proves merely that the German universities are superior to *foreign* universities, not that they are perfect. The most distinctive and most admired feature of the German universities, which has made them the world's schools of high scientific education, is the personal influence, analogous to the influence of the master upon the apprentice, which teachers, who have added much to the world's store of knowledge, exert upon the students whom they are introducing to the field of original research. The foreign students, as a rule, come prepared with a good elementary scientific education, for the purpose of learning the higher

branches and the art of research. Hence they are soon admitted to the master's intimate presence and influence, and, working with him, experience the wonderful and never forgotten joy of creative work.

The professor is not so fortunate, for, in addition to these well prepared devotees of pure science, he has on his hands a much larger number of students, almost exclusively native, who intend to follow technical pursuits and whose principal immediate interest is in the examinations. In the faculties of law, medicine and theology, such students form so large a majority that they almost monopolize the professor's energies and make it impossible for him to establish a school of research with his few original investigators. The philosophical faculty, on the contrary, is the true home of professors who, in addition to their regular duties as teachers, accomplish much original research, with the collaboration of a fairly large body of embryo investigators.

But even here the incompatibility of the two sides of the professor's work almost always leads to neglect of one or the other. The more famous a professor's department becomes as a school of research, the greater is his tendency to confine his personal attention to the students of research and to delegate to assistants the instruction of other students.

This difficulty is of recent growth. When the number of students was small both kinds of instruction could be given by one person. The regular instruction of the beginners was usually carried on by assistants, but even these students came frequently under the personal influence of the professor. This method is seldom practicable at present, as the number of students is so large that it is physically impossible for the professor to give personal instruction to each individual as often as once in a week. The instruction of the less advanced students, therefore, is left entirely to tutors. These indispensable and overworked assistants have little influence in university councils and are consequently discontented with their position.

This discordance in the professor's functions is manifested even in his appointment. He is usually chosen in consequence of his accomplishments in the field of original research, while his ability to teach is taken for granted, and treated as a matter of secondary importance. But many great investigators are poor teachers, and, on the other hand, a professor who strives conscientiously to fulfill his duty as a teacher cannot accomplish much original work. In their relations in the faculty the two types, the good investigators and the good teachers, stand in latent or open mutual opposition, as the latter feel that they are regarded as inferior to the former, although they—the teachers—best perform the immediate function of the university.

Hence we must expect a division, not precisely between research and instruction, but between technical instruction and instruction in research, or even research without instruction of any kind. In other words, we must have schools for preparing students to follow definite scientific pursuits, and other institutions designed for the advancement of science by original research, with or without personal instruction, according to the character and special talent of their chiefs.

Institutions of this kind are already in existence. In Frankfort alone there are several institutes (those conducted by Prof. Ehrlich and by Prof. Edlinger, for example) which are perfect illustrations of the type described above. They have nothing to do with technical education for special callings, and they accept only students whom the head of the institution regards as promising collaborators.

The obvious corollary to this development is the return of the universities to the type of the technical school. This does not mean that university teachers will abstain from all original investigation. On the contrary, the younger men will undoubtedly do such work, according to their capabilities, if only for the purpose of winning positions in the schools of research. But every university teacher will be required to devote his energies chiefly to the work of teaching.

In this way the faculty will soon be made homogeneous by the elimination of those who are especially well fitted for research, and a source of manifold difficulties will be removed.

This transformation involves a reform in the intermediate schools. It will finally be comprehended that the last two or three years of school work, as conducted at present in Germany, are a robbery of the personal freedom of the scholar and the intellectual wealth of the nation, and that these years could be more profitably employed in a university of the new type. In short, the German university must return, in some degree, toward the type of the English and American college, from which it has been removed by adding instruction in research to its functions.

These transformations will not be effected without great opposition. In particular, protests against the "degradation" of the universities will be uttered by university teachers, and most loudly by those who are teachers rather than investigators.

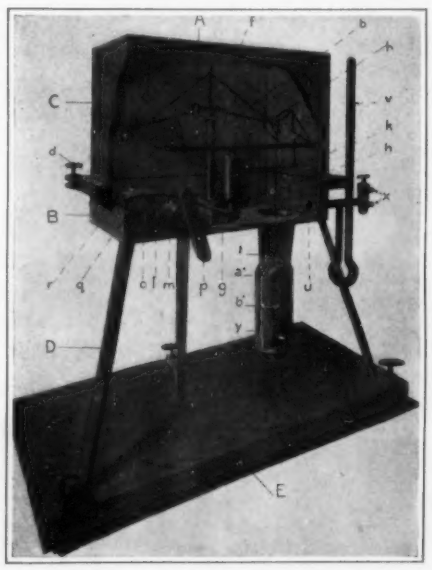
In the establishment of a new institution, at least, the sharp distinction between the two functions of the present university, which has already manifested itself in a practical way, should be borne in mind, and the institution should be designed exclusively for the accomplishment of one or the other object, as it cannot satisfactorily accomplish both.

A Balance for Weighing One Ten-thousandth Part of a Milligramme

WITH ordinary chemical balances weights can be determined to within 1/10 milligramme (1/650 grain). This degree of accuracy is quite sufficient for most purposes, but greater precision is required for the solution of the new problems in chemistry which have followed the discovery of radium and other radio-active substances.

We know that radium, uranium and thorium are subject to slow but sure spontaneous decomposition, and it is not impossible that other elements obey the same law. It is quite impossible to detect such decomposition by means of loss of weight if we employ ordinary chemical balances, for even radium loses less than two millionths of its weight in a day, or 1/1600 of its weight in a year.

Steele and Grant have devised a balance with which a loss of weight as small as 1/10000 milligramme can be determined with accuracy. This balance, the precision of which can be increased to



A balance for weighing 1/10000 milligramme.

1/250000 milligramme, has already been employed by Ramsay to determine the loss of weight of radio-active substances.

The following description of this marvelously sensitive instrument is quoted from the *Proceedings* of the Royal Society.

The construction of the balance is illustrated by the accompanying engraving. The balance is inclosed in an air-tight metal case which is supported by three legs *D*, terminating in leveling screws which rest on a marble base *E*. The cover of the case *C* is attached to the bottom *B* by means of the screw *d*. The air is drawn from the case through the three-way cock *x*, and the degree of rarefaction is indicated by the vacuum meter *v*. The apparatus is very much smaller than an ordinary balance. The case is about 5 inches long, 4 inches high and 2½ inches deep. The beam of the balance *A* is constructed of very slender rods of quartz, arranged in the form of two triangles, and is provided with a knife edge of rock crystal *F*, which rests on the metal post *b*. The balance pan *b'* is suspended from the right arm, while the left arm carries a quartz bead, which serves as a counterpoise. Especial care was devoted to the mechanism for stopping the oscillation of the balance, without injuring the delicate instrument, affecting the accuracy of the weighing or admitting air into the case. By turning the handle *p*, the shaft *l* is rotated in the bearing *m*, causing the cam *o* to raise or lower the spring *q* which is hinged at *r*. The movement of the spring is communicated to the vertical cylinder *g* and the horizontal rod *h*, which carries two small triangles of quartz fibers which embrace the arms of the balance.

It would be impossible to use weights of platinum or even of quartz for the exceedingly delicate measurements for which this balance was designed. The substitute for weights is the most original feature of the apparatus. A thin quartz bulb *a'*, filled with air and sealed, is suspended from the right arm of the balance, above the scale pan *b'*, to which a small auxiliary weight *y* can be attached if necessary. This part of the apparatus is contained in the glass tube *t* which projects below the bottom of the metal balance case, to which the mouth of the tube is attached by an air-tight joint. A little phosphoric acid is placed in the bottom of the tube, to absorb every trace of moisture. The effective weight of the sealed quartz bulb *a'* increases as the air pressure inside the balance case and tube diminishes.

An experiment to determine the loss of weight of a radio-active substance is conducted as follows: A little of the substance, not exceeding 1/10 gramme (1½ grains) in weight, is placed in the scale pan and balanced by adjusting the weight of the quartz bead carried by the other arm of the balance. The final adjustment can be made with great accuracy by heating the slightly too heavy head in the oxy-hydrogen blow pipe until a sufficient quantity of quartz has been vaporized. The movements of the balance are read by means of a little mirror, attached to the beam (directly under *A* in the illustration), which reflects the rays of a lamp to a cathetometer. As the substance in the scale pan loses weight the equilibrium is disturbed, and the pan *a'* and quartz bulb *b'* rise. The loss of weight is determined by exhausting air from the balance case until the equilibrium is restored. From the readings of the vacuum meter *v* at the two moments of equilibrium, the loss of weight can be calculated. A change of 1 millimeter in the reading of the vacuum meter corresponds to a change in weight of about 1/76000 milligramme. As the height of the mercury column can be read accurately to 1/10 millimeter, it is thus theoretically possible to detect a change in weight of little more than one millionth of a milligramme, but friction and other sources of error reduce the precision attainable in practice to from 1/10000 to 1/250000 milligramme.

Prodigals and Vandals

RESPECT for Nature and all her works is one of the best achievements of civilization, and the most highly civilized country is that in which purposeless destruction and wanton waste of natural treasures are most generally deprecated. Fortunately, we cannot annihilate matter, but we can convert highly organized and even living matter into the dead products of total dissolution. To do this without adequate reason is abhorrent in proportion to the clearness with which we recognize our relation to the Cosmos, i. e., in proportion to the degree of our civilization. Although no one, probably, will question the correctness of this principle, almost everybody often violates it, usually in thoughtlessness rather than in malice.

A protest against the wholesale slaughter of birds for their plumage has been made with vigor, and perhaps not altogether without effect. Laws designed to prevent the total extinction of game have long been in force in all civilized countries, and all true sportsmen deplore the senseless slaughter of whole herds of antelopes and elephants in Africa.

Prof. Otto N. Witt, a distinguished German chemist, who writes entertainingly of many things besides chemistry, and who devotes his latest contribution to *Prometheus* to the wanton waste of Nature's gifts, thinks that plants should also be protected by public opinion, if not by law. He is heartily in favor of the sale of cut flowers and of potted plants, but he denounces the vandalism of edelweiss hunters, Alpine tourists and summer excursionists in general, and withers with his sarcasm both the vender and the purchaser of a costly basket crammed with dozens of un-potted and amputated plants in full bloom, ruthlessly butchered to make a German holiday and to advertise the wealth and liberality of the donor. But—to paraphrase the words of the lamented Lorenzo the Seventeenth—what is Dr. Witt's mean and petty German extravagance, compared to our royal American extravagance?

Dairy Investigations

TWENTY-EIGHT new associations for the co-operative testing of cows belonging to members were formed during the year; 55 are now in operation. Such tests, enabling the owners to discard unprofitable cows, raised the average annual profit per cow in one association from $21.43 to $42.82 in four years.

The score-card system of dairy inspection recommended by the Department of Agriculture helped to improve sanitary conditions in dairies. It is being used in 117 cities and towns, including some of the largest cities. Great improvement has been brought about in the milk supplies of a number of cities.

"Aki," the First Japanese Dreadnought

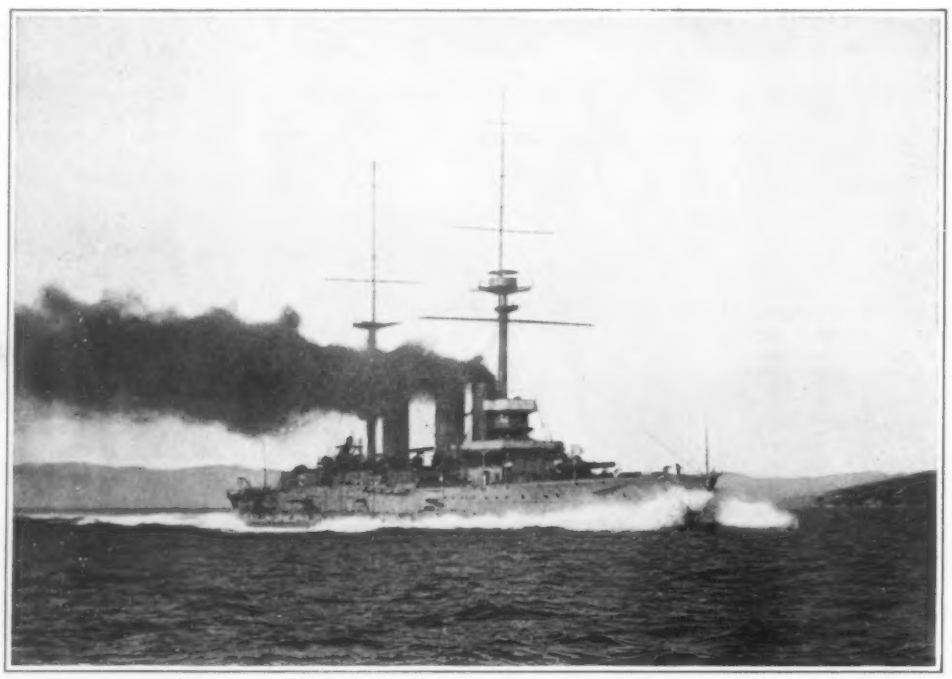
Turbine Engines Drive the Ship at 20.2 Knots

AN event of more than usual importance to the Japanese navy was the recent speed trials of their first dreadnought battleship, the "Aki," during which the vessel considerably exceeded her contract horsepower and speed. To Americans, the vessel will be of particular interest because of the fact that her propellers and turbine engines are of American design and manufacture, both of these being constructed at the yards of the Fore River Shipbuilding Company.

The "Aki" was built by the Japanese at Kure, Japan. She was laid down in March, 1905, and completed in December, 1909. The vessel is 492 feet long, 84 feet broad, and has a maximum draft of 28¾ feet. Her length over all is 499 feet, and the normal displacement is 19,750 tons. The protection of the "Aki" is moderate only, the main belt being 9 inches thick amidships, 6 inches at the bow and 4 inches at the stern. The main battery is protected by from 8 to 10 inches of armor. In view of the fact that our 45-caliber, 12-inch gun has penetrated 10-inch armor at 8,000 yards range, the protection of the vitals in this ship must be considered rather too light. The armament of the "Aki," however, is unusually heavy for a vessel of her displacement. All the guns are 45 calibers in length. Forward and aft are two 12-inch. On the broadside, in two-gun turrets, are twelve 10-inch. All of these main guns are mounted on the upper deck, which has an average freeboard of 19 feet, the axes of the guns being, therefore, from 23 to 25 feet above the normal water line. On the gun deck are twelve 6-inch, widely distributed, eight of these being protected by the 6-inch armor of the central battery. The torpedo armament is heavy, consisting of five torpedo discharge tubes. The "Aki" has the great defect that when she is fighting a broadside engagement, no less than six of her 10-inch guns, being on the lee side of the ship, will be masked by the smokestacks and the turrets on the opposite beam, and will therefore be idle.

The Curtis turbines with which the "Aki" is driven are 12 feet in diameter, and they were contracted to show an aggregate horse-power of 24,000. The vessel was originally designed for 19-knot speed, which was to be obtained with reciprocating engines; but subsequently, it was resolved to substitute a pair of Curtis turbines driving twin propellers.

In the recent progressive official trials, at 94 revolutions per minute and 1,352 shaft horse-power, the "Aki" was driven at 8.4 knots for a consumption of 31.9 pounds of steam per horse-power per hour. At 160 revolutions and 5,773 horse-power, the speed was 13.9 knots for a consumption of 19.5 pounds of steam per horse-power per hour. At 221 revolutions and 16,115 horse-power, the speed was 18.6 knots for a consumption of 15.3 pounds of steam, and at 259 revolutions and 27,740 shaft horse-power, the speed was 20.2 knots for a consumption of 14.4 pounds of steam. The Minister of Marine of the Japanese navy was so highly pleased at the showing of the ship that he sent a congratulatory telegram to the commander upon the completion of the trials, which action was "very unusual and very gratifying to the captain and the men." A sister ship to the "Aki," the "Satsuma," is also practically completed.



Displacement, 19,750 tons. **Speed,** 20.2 knots. **Armor:** Belt, 9 inches; main gun positions, 10 inches to 8 inches. **Armament:** Four 45-caliber 12-inch; twelve 45-caliber 10-inch; twelve 45-caliber 6-inch. **Torpedo tubes,** 5 submerged.

The Japanese dreadnought "Aki" making 20.2 knots on trial

Growing Old

FROM a recently published account of the lives and habits of a number of very old persons it appears that none of them made a study of hygiene, visited health resorts, indulged in recreation tours, or tormented his body with the multitudinous drugs and instruments of the art of healing. The secret of their long and healthy lives is found in moderation in eating and drinking, a calm disposition, and regular exercise of their physical and mental powers.

A great many persons are doomed to premature death, preceded by long suffering and progressive debility, by the rapid wearing out of some vital organ—the heart, lungs, kidneys, liver, brain, or arteries. The recognition of the causes of such diseases suggests methods of preventing them. More suffering, premature old age, and death have been caused by the undue importance formerly ascribed to an abundant supply of albuminous food than have resulted from many famines. As a furnace is choked by incessant stoking, so overfeeding from infancy paralyzes the activity of the excretory organs (kidneys, liver, glands, etc.), the organs of circulation (the heart and arteries), the nervous system and the organs of digestion. When too rich a diet is supplemented by regular doses of alcohol, every condition favorable to early collapse is provided.

The recent investigations of Prof. Chittenden have proved that the most healthful ration of albumen is very much smaller than had been assumed, and that five or six ounces of albumen per day are quite sufficient for a hard-working man. With this comparatively small albuminous ration the lamp of life burns brighter and the mental powers are increased.

Life is shortened, also, by changes in the connective tissue which binds the organs together and which appears most conspicuously in the tendons, ligaments, membranes, and skin. Many of the obvious phenomena of old age are caused by the hardening of this originally tough and elastic tissue which, like India rubber, loses its elasticity through age and disuse, producing bowed shoulders, stiff joints, wrinkles and brittle arteries. The hardening and shrinking of connective tissue extend to the brain, and explain the fact that recent events are forgotten while youthful experiences are vividly remembered. The deep and permanent impression which thoughts and occurrences make in the soft wax tablet of the young brain becomes impossible in age.

All of these things point out the means by which premature senility can be averted and old age prevented from becoming a burden and a torment—moderation in eating and drinking, ample rest and regular moderate exercise of all the bodily organs, to retard the stiffening of connective tissue.

Prof. Chittenden's albuminous ration for a hard-working man stands in striking contrast to the great quantities of meat eaten by many men of sedentary habits. The exercise required by the muscles and joints can be obtained by a regular system of exercises which need not occupy much time.

Dr. Meyer, whose article in *Illustrirte Zeitung* is here summarized, recommends the system devised by J. P. Mueller. Such exercises, of course, should be used in time, as they are preventives, not cures, for senility. Daily long walks, preferably in the mountains, tend to invigorate the heart and the circulation. When vigorous exercise is impossible, or when it is desired to prepare for it or supplement it, massage will be found useful. Swedish facial massage produces an excellent cosmetic effect by obliterating wrinkles.

As mental activity exerts a beneficial influence on the bodily functions, occasional change of scene, reading, thinking, interest in sports, contact with mentally stimulating persons and social intercourse with young people are recommended. Occasional journeys, despite, or rather because of, their many disagreeable concomitants of noise, hurrying throngs, rapidly changing sights and sounds, and variations of atmospheric pressure, appear to stimulate the entire organism, while absolute rest and indolence promote the hardening of connective tissue and the accumulation of fat. Exercises in memory prevent and diminish hardening of connective tissue in the brain as bodily movements prevent the general stiffness of old age. In short, the most formidable enemy, connective tissue, should be kept mobile everywhere in order to preserve elasticity of body and mind.

As many persons exhibit a steadily increasing intolerance of alcohol, tobacco, and coffee, the enjoyment of these luxuries should be restricted, and should be entirely renounced in all cases where there is a predisposition to apoplexy or chronic kidney disease.

The average term of life appears to have increased in the nineteenth century, and there is every reason to believe that it is still increasing. The world will be greatly benefited when its old men shall be able to increase and utilize for the common good the fruits of their long experience, and when men like Cornaro, who wrote scientific treatises at the age of 95, and the eminent Latinist, Prof. Mayor, who is still working diligently at the age of 85, shall not be rare exceptions.

Improving the Port of Liverpool

ALTHOUGH the port of Liverpool will not be the British terminal for the new White Star liners, no cessation of the activity in dredging operations and development of dock facilities for the improvement of the port is being displayed. Last year the five dredgers in the service of the authorities removed 18,879,460 tons of sand from the bar obstructing the entrance to the channel, of which aggregate the new huge dredger "Leviathan," fully described in the SCIENTIFIC AMERICAN, raised 12,121,700 tons. Since dredging operations were seriously taken in hand in 1890, no less than 152,541,910 tons of sand have been removed from the shoals at the bar, and the result is that there is now a channel at the bar 700 feet wide with only one sounding less than 32 feet at low water equinoctial spring tides, while in the part of the Queen's Channel lying between the bar and Formby lightship a minimum depth of 27 feet has been secured, and the rest of the channel has a depth of 31 feet or more over a width of 1,000 feet. The construction of a new dock estimated to cost $2,500,000 has been commenced, and this is the first instalment of an extensive dock improvement scheme computed to entail an expense of $17,500,000. The new dock will be about 1,200 feet in length, with an entrance 120 feet wide, and having a depth of 35 feet on a ten-foot tide, and a depth of 45 feet on a twenty-foot tide. It will be approached by a channel 400 feet in width at the mouth narrowing to 120 feet wide at the dock entrance. This dock will be fully capable of accommodating the new 45,000-ton White Star liners, and the improvement scheme has been taken in hand to meet the requirements of the 40,000 to 50,000-ton boats which are believed to be in the near future the combined passenger and cargo boats to be employed in the New York service.

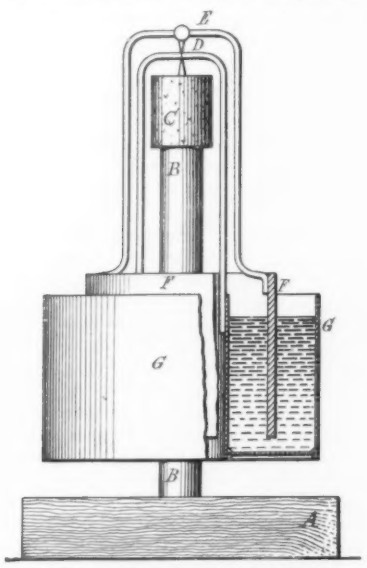
How do You Like the Home Laboratory?

THE referendum on the question of publishing Handy Man's Workshop every two weeks, instead of once a month, has brought in a number of letters expressing approval of the Home Laboratory. Such letters are a great help to the Editor of this department. He would like to have more of them. He wants to hear from all his readers. Tell him how you like the department and what features interest you. If you wish that certain subjects were left out and others put in, do not hesitate to say so. The Editor is always glad to receive contributions for the Home Laboratory, and he pays for them promptly if they are available.

A Combined Battery and Motor

By Chauncey W. Nieman

THE apparatus here described is probably the simplest and most self-contained electric motor it is possible to make. It has no brushes, commutator, windings, or other parts commonly associated with a motor. Moreover, it has its own battery within itself. Any one can make it, but to explain its action



Combined battery and motor.

is quite puzzling, as it is so different from any other machine of its kind.

In the illustration *A* is a wooden base with a hole in the middle in which the bar magnet *B B* is inserted. This magnet should be as large as can be obtained and 8 to 10 inches long. Two slender magnets can be fastened together with the poles against each other if a single magnet of the right size is not readily obtainable. Over the top of the magnet the cork *C* is placed, which has a hole cut for the purpose. In the top of this cork a needle is stuck, point upward. At *G* is an annular vessel of thin sheet copper. It is easily made by cutting a ring of copper for the bottom and bending two cylinders of sheet copper, one to fit around the outside of the ring and the other inside. The three parts are then soldered together. When this is done all the soldering appearing on the inside of the vessel must be painted or covered with paraffine so as not to be acted upon by acid. The vessel is suspended by the wire *D*, attached to it in two places. This wire is bent into a loop as shown, and where it passes over the needle a center-punch mark is made for a bearing.

A sheet of thick zinc is then bent into a circle, of such size as to lie inside the copper vessel and be at about equal distances from the inside and outside walls. To the top of the zinc cylinder the wire *E* is attached in two places by solder or by passing through two little holes in the cylinder. At the top of the loop a second needle is soldered with its point down, and in the upper side of the wire *D* another center-punch mark is made to receive it. Both the loops *D* and *E* should be so bent as to be as close as possible to the magnet.

By setting up the apparatus as shown and filling the copper vessel with dilute acid the current may be caused to pass up on both sides of the wire *D* and come down on both sides of the wire *E*. The outer vessel will then immediately start to turn in one direction, while the inside cylinder will revolve in the opposite direction, producing a very animated effect. The action will continue as long as the acid holds out. The apparatus will last a long time, as there are no parts to get out of order, and the simple but effective mechanism will prove a constant source of wonder to admiring friends.

Projectile Photography

By Norman Barden

NEARLY all of the fascinating work of photographing projectiles in flight has been done in large laboratories, and those interested in this subject have felt that they had not the required apparatus for such experiments. Now the purpose of this article is to set aside these ideas and to give a clear idea of the whole operation. It may well be said that any student attending a school or college possessing a physics laboratory can succeed in obtaining good negatives of projectiles in flight. As a rule the most serious drawback is the lack of an induction machine, but it is quite possible to use an induction coil in its stead. In the following lines a description and explanation of the complete operation as carried out by the writer in the physics laboratories of the East High School of Minneapolis, Minn., will be given.

The bullet emerging from the muzzle. Note the smoke preceding the bullet.

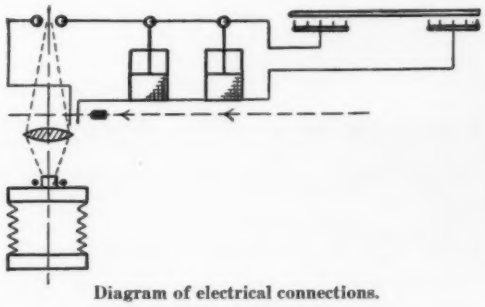
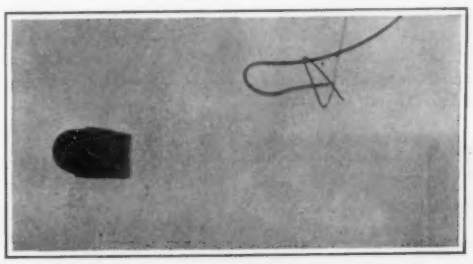


Diagram of electrical connections.

The apparatus used in this method of photographing projectiles in flight consisted of an induction machine, a battery of Leyden jars, a spark gap, large condensing lens and a camera. A view of the complete apparatus arranged in a working condition is shown herewith. At the extreme right will be seen the gun clamped rigidly to the table. Placed on the table to the left and back of the gun is the induction machine. Just to the left of the static electric machine is the battery of Leyden jars. Then further to the left is the spark gap, directly in front of which



The bullet in flight; muzzle velocity, 903 feet per second.

are the condensing lens and camera respectively. The framework which shows near the Leyden jars is a device for holding two wires by means of which the spark is caused to jump at the spark gap by the bringing of the two wires referred to in contact with one another. The whole operation is carried on in a perfectly dark room save for a dim ruby light. The arrangement of the apparatus is clearly shown in the accompanying diagram.

The arrangement of the apparatus is as follows: The gun is first clamped tightly in a rigid position. Then a target for stopping the bullet is put in position. A target can be made either of blocks of wood or by tying several thick magazines together. Before arranging the rest of the apparatus the path of the bullet must be found. This is done by placing two pieces of cardboard in vertical positions in the apparent path of the bullet. Put one about a foot in front of the muzzle of the gun and the other a foot to the far side of the point where the camera is to be placed. A shot is now fired, puncturing each cardboard. Now by sighting through one hole in the cardboard to the hole in the other, the path of the bullet may be located to a nicety. The next piece of apparatus to be set up is the framework for holding the contact wires or strips in the path of the bullet. The contact wires are placed vertically and must be exactly in the path of the bullet. For the contact wires or strips No. 36 copper wire or leaf copper wire will serve the purpose very well. Having put the framework in the proper position proceed to place the spark gap and the condensing lens and camera in their positions. There can be given no definite measurements for the placing of the last named pieces of apparatus, as different experimenters will probably have different kinds of instruments. However, it is best to place the condensing lens, which should be five or six inches in diameter, about two inches from the path of the bullet. Set it on the side on which the camera is to be located. A condensing lens having a focal length of about six inches will be found to be very well suited for the purpose. Now put the spark gap at such a distance from the lens that the pencil of rays converging from the lens will be brought to a focus at about eighteen inches from the path of the bullet. Then place the camera so that its lens is at the focus of the pencil of rays just referred to. The camera should be focused on the path of the bullet in order to get a sharp image of the projectile. The optical axis of the camera ought to be perpendicular to the path of the bullet, and the spark gap placed on this axis; also the axis of the condensing lens should coincide with that of the camera. For a clear idea of the arrangement of these pieces of apparatus consult the diagram. Set

Arrangement of the apparatus for photographing a bullet in flight.

the Leyden jars and the induction machine in any convenient position. By following the arrangement in the diagram a great deal of unnecessary wiring and a large amount of electrical leakage which is at times very troublesome will be avoided. Connect the machine with the Leyden jars and the jars in series with the spark gap and the second break, thereby making two breaks in the circuit. For the connecting wires annunciator wire may be used; but it should run from one connection straight to the other. Wherever the wires are to be supported they must be highly insulated. Pieces of glass tubing are very convenient to use. Also wherever a wire might touch anything which might give way to leakage or a short circuit, insulate it with glass tubing or mica. Having put the apparatus in a working condition proceed to try out the experiment.

First of all see that the contact wires are placed exactly in the path of the bullet and that they are about a quarter of an inch apart. Bend one wire so that the other will surely come into contact with it. Adjust the spark gap so that the terminals are about a quarter of an inch apart. Now operate the machine until the current jumps through both breaks. Do this several times and look for defects in the wiring. On finding everything all right, stop the machine and fully discharge the Leyden jars. Now find out how many turns of the induction machine handle will charge the jars so that they will discharge through both breaks. Do this several times, discharging the jars between each trial, and find the average number of turns. Now try it again, but this time give it four less turns and then push the contact wires together with a glass rod or other good insulator. If the spark is produced at the spark gap when the contact wires are brought within a sixteenth of an inch of each other, the correct number of turns has been found. Now load the gun and cock it ready for firing, turn the handle of the static machine the correct number of turns and at the last turn fire the gun. At the

same time watch the spark gap to see if the spark was produced or not. After having put all the apparatus in a working condition try a plate.

Nothing has been said heretofore regarding the kind or size of plates or the kind of camera to be used. For the camera one with a lens of large aperture is preferable to one of small aperture. However, the lens of almost any camera may be used if the pencil of rays coming from the condensing lens is focused exactly upon the center of the camera lens. For the plates, fast ones are best to use, and the faster the plate the better the picture. The writer used Lumiere Sigma plates with good results. The plates should be large enough to show about four or five inches of the path of the bullet. By consulting the illustrations it will be seen that the contact wires were placed so that they just showed on one side of the plate, thereby leaving the rest of the plate to catch the projectile.

After exposing the plate develop it immediately or in a short time. Use any reliable developer and use a solution of such strength that developing will not have to be carried on for more than five minutes. Fix the plate in a strong acid hypo solution and let it fix about twice as long as it takes it to clear. Wash the plate thoroughly and dry it in such a position that the dust will not settle upon it. It will be found convenient to make the dark room in which the experiment is carried on, serve as the photographic dark room. This saves a great deal of time as well as trouble. If the foregoing instructions are followed, the writer feels confident that there will be no great trouble in obtaining good negatives of projectiles in flight. A great deal depends upon the experimenter, and he must depend upon himself to correct some possible defects which might arise from his own methods of wiring and arranging the apparatus. There is still a large amount of knowledge to be gained by this fascinating work, and it is within reach of a great many who do not realize the possibility of their carrying out this experiment.

In one of the illustrations at the left is seen the muzzle of the gun and the projectile which has just emerged from it. Around the back part of the projectile are seen the jets of expanding gases. The volume of smoke and gas which precedes the bullet from the barrel is shown very plainly. The white streak is the spark between the contact strips. Many interesting and instructive pictures of this sort are in reach of those who follow out the foregoing explanations and instructions.

The writer wishes to say that he is greatly indebted to Prof. J. R. Towne, of the Department of Physics at the East High School of Minneapolis, Minn., as it was through his kind permission that the use of the laboratories was obtained for carrying out this interesting experiment.

Neat Method of Testing Shutter-speeds

By H. H. F. Clarke

IT is always better to test the speeds of instantaneous shutters to see if they give the correct exposures after one has had them for some time, more especially when they are bought second-hand. In some cases the wood either swells or contracts. This is due to various causes, chiefly sun and damp, and the shutter, though apparently running freely, runs slower due to friction.

Take a piece of fairly thin board *AA* and drill a small hole through it. On one side of this hole attach, by means of a very weak spring, a sheet of mica *K* so that it just touches the board. A piece out of a discarded recorder does very well. To the center of this fasten another light spring *I*, which has a very fine brush composed of a few camel hairs tied on the end. Do not attach the springs (which can be made out of watch main springs, softened, filed down, and then retempered) with sealing wax, as it is too brittle. Some of the cements used for mending china do very well, or even strong spirit gum does at a pinch.

Now take a worn-out gramophone disk and paste a white piece of paper of the same size over it. The paper should be cut to the required size, a good layer of paste put over it and laid aside for ten minutes, then another layer of paste applied and the whole firmly pressed against the disk. The paper will then dry with a perfectly smooth surface. The object of the first layer of paste is to stretch the paper, which, when placed on the disk and allowed to dry, shrinks, thus forming a perfectly level surface.

Now fit the prepared disk on a gramophone and clamp the apparatus, described above, so that the little brush, which has been previously soaked in some coloring matter (red ink does very well) very nearly touches the paper, but as near its edge as possible. Set the gramophone running at a known rate. Now place the shutter to be tested over the hole in the wood and project a gentle stream of air, either with the mouth or foot bellows, through the tube *C* against the shutter *DD BB*. Release the shutter, and the stream of air passes through, reaches and depresses *K* a fraction of an inch and causes the brush *I* to mark a line on the gramophone disk *G*.

Now, say you set the gramophone going at 120 revolutions a minute, divide this by 60. Then the disk makes two complete revolutions in a second.

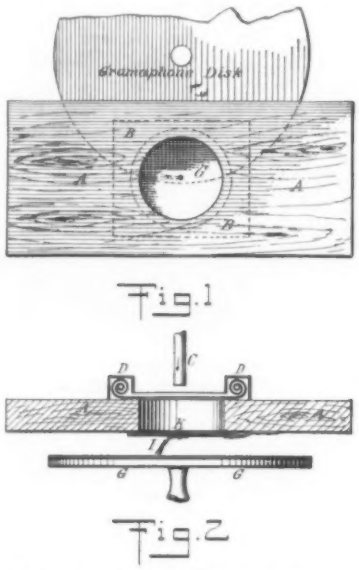


Fig. 1

Fig. 2

Testing a shutter with a gramophone.

Measure the distance from the mark made by the dye-soaked brush to the center of the disk; call it x. Multiply this length by 6.28. Then $6.28 \times x$ is the distance traveled by a point on the disk, at the same distance from the center as the brush, in one complete revolution. Now there are two complete revolutions in one second, so the distance traveled in one second is $6.28 \times x \times 2$. Now measure the line marked by this brush; call this y. Then the speed of the shutter will be $\frac{y}{6.28 \times x \times 2}$ seconds, or expressed in another way $\frac{6.28 \times x \times 2}{y}$ part of a second.

Most gramophones and phonographs have an accurately governed motor, and when the regulator is put at a certain mark the disk travels at so many revolutions a minute. If this is not the case with yours, you can easily determine its speed with a little ingenuity. Either notice how many revolutions the disk makes for one revolution of one of the slower running gear wheels, and from this calculate the number of revolutions in a second, or else fix a small piece of white paper to a disk and count the number of times it passes a certain mark in a definite number of seconds (a convenient number is ten).

Either a gramophone or phonograph may be employed. Perhaps the gramophone is a little better, as the line you get is longer and so your work is a little more accurate if anything. It is necessary to notice that the apparatus is fitted up so that the spring brush is not torn off when the mica plate is depressed by the current of air. If fixed up in one way, as can easily be seen, the spring will be bent back and probably torn off the plate.

Improvised Stereoscopic Camera

By John E. Mellish

THE writer possesses a 5×7 camera with an exceptionally fine lens and with a double extension bed. Desiring to take some stereoscopic views with this camera the following scheme was hit upon: To start with, a stand was made with three legs and a flat top fifteen inches square. A lath was secured to the top at one edge, forming a guide rail against which the camera was set. With this simple contrivance stereoscopic views were easily obtained. The camera was set on the stand against the lath, but a little to one side of the center, and the focusing was done carefully on the ground glass. The lens was stopped down in order to bring out details clearly. After exposing one plate the camera was moved sidewise and a second view was taken. For objects near by the camera was moved laterally about three inches, but for distant objects and scenes, the lateral displacement was as much as a foot. In this way two views were obtained that were found to show up with wonderful distinctness in a stereoscope. The accompanying illustration shows two views taken in this way. It was essential in this case to pick out an hour when no wind was stirring so that there would be no blurring of the leaves.

Stand for taking stereoscopic views.

Stereoscopic picture taken with a single lens.

Silvering Reflectors

SEVERAL letters have been received by the Editor of Home Laboratory, complaining that the directions given in the article on the Construction of a Four and One-half Inch Reflector must be wrong; for even though they were carefully carried out no silver would adhere to the glass. The failures appear to be due to the following causes: First. Nitric acid containing a trace of chlorine would give a faint precipitate which would prove fatal in getting a perfect deposit of silver. Second. The glass may not have been made sufficiently clean. Third. Common water if used to mix the chemicals for the solution would also cause precipitate of silver chloride, sulphate, and an organic compound of silver, thus causing failure. The water used for the mixing and final washing before silvering *must* be distilled water.

The following solution for silvering can be entirely relied upon, but distilled water *must* be used in making the solution. The process is known as "Martin's Silver Process:"

Solution A. Nitrate of silver, 175 grains; distilled water, 10 ounces. Solution B. Nitrate of ammonium, 262 grains; distilled water, 10 ounces. Solution C. C. P. caustic potash, 1 ounce (av.); distilled water, 10 ounces. Solution D. Pure white sugar candy, ½ ounce (av.); distilled water, 5 ounces.

Dissolve this by heating the flask and add fifty grains of tartaric acid, boil this mixture for ten minutes in the flask and when cold add one ounce of pure photographic alcohol, made up to ten ounces by adding distilled water.

For use mix equal parts of A and B in one graduate, and equal parts of C and D in a separate graduate. Finally mix these two together and suspend the glass to be silvered face down in this mixture; allow it to stand until the deposit of silver is complete.

The glass can be cleaned by very carefully washing it in a warm solution of common washing soda, with a tuft of absorbent cotton pressed in the end of a stout rubber tube and used as a mop. Wash well under the faucet, then rinse well in a mixture of nitric acid one part to forty of water, and rinse well under the faucet. Finally wash in distilled water, drain, and then immerse in the silvering liquid.

Tungsten Wire

DUCTILE metallic tungsten is now produced in the electric furnace. Tungsten particles have been hitherto welded into a continuous filament by passing an electric current through a binding material containing the metallic particles and driven off by the high heat. By this new method the metallic tungsten can be drawn into fine wire much stronger and more rugged than the sintered filament.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

James J. Newton

THE subject of this sketch was born on a farm in Morgan County, Georgia, July 17th, 1861, the sixth of a family of eight children. Both his parents

James J. Newton.

were strong and vigorous, and he inherited an iron constitution which has enabled him to make the exceptional record of attending to his official duties for a period of fifteen years of official life without a day's absence on account of sickness.

Mr. Newton was educated in the common schools and the University of Georgia, from which institution he graduated with distinction in 1881. He was elected to the position of Instructor of Chemistry and Physics in the South Georgia Agricultural College at Cuthbert, Georgia, in 1881, and in 1885 was elected principal of Lee Institute at Thomaston, Georgia, where he taught until he came to Washington in 1890. In 1891 he took the examination for admission to the Patent Office examining force and was appointed fourth assistant examiner in March, 1891, and assigned to duty in Division 9. He passed his first examination for promotion in November, 1892, standing fifth in a class of about fifty fourth assistant examiners. He was made law clerk in May, 1893, chief clerk in 1894, and principal examiner in 1895, and assigned to duty in Division 23, where he has served continuously ever since.

To this division was attached the present division of trade-marks until 1897, and in addition thereto the classes of acoustics, measuring instruments, including weighing machines, adding machines, cash registers, etc., and horology.

As indicating the wonderful growth of these arts since 1895, trade-marks have been assigned to a separate division, and the work of a large force is necessary for their examination. Acoustics, including phonographs, which in 1895 only required a small portion of one man's time, now take up one man's entire time; and adding machines, which were all examined by one man, now require the united efforts of three to keep up the work. Probably three-fourths of the patents in these arts have been issued since Mr. Newton took charge of this division in 1895.

One of Mr. Newton's strongest characteristics is attention to business. He is a most assiduous worker. If you want to see him, you are certain to find him at his desk and just as certain to find him at work. He once told the writer he had never felt himself overworked, and this, too, when the character of work coming to his division was of the most difficult kind and required constant and diligent labor to keep it down.

Mr. Newton is a lawyer, graduated from the law school of Georgetown University in 1895, and is the author of "Newton's Digest of Patent Office Trade-Mark Decisions," published in 1896.

A Film-developing Machine

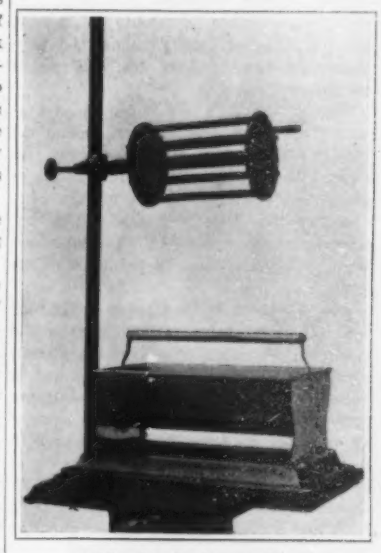
By A. A. Somerville

THE accompanying illustration shows a new apparatus designed by Prof. George S. Moler of Cornell University for use in developing photographic films. The device excels in its simplicity—all parts are plainly in sight. It was constructed to fill a definite need, to supply which there is nothing on the market.

The vessel containing the developer is an Ingento tank, this type being chosen as particularly adapted to the mode of procedure followed. It is semi-cylindrical, and in operation the film slides over the bottom, following its curvature, and is immersed in the developer in such way as to present to it the greatest possible length of film. A rod extends from one end of the tank to the other, about one-fourth of an inch from the bottom, and the film is passed through under this rod, so as to be held down under the surface of the liquid while the ends of the film are passed in and out in see-saw motion. (In the illustration the transverse rod is shown turned up out of the tank.) In the ordinary use of this tank the difficulty arises that it is rather troublesome to hold the ends of a long film out at arm's length and rock them to and fro with the requisite see-saw motion. A person is almost sure to fall into the habit of holding the film in the shape of a V, and if the angle of the V is spread out too much, as it is very apt to be, the film drags over the edges on either side of the tank, and by adhesion raises the developer out of the tank and spills it over the working table.

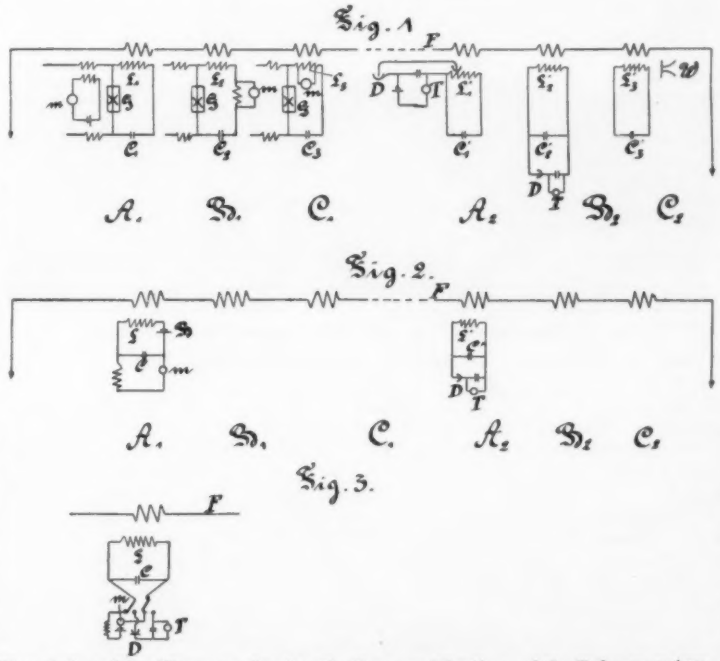
To remedy this defect, and at the same time gain other advantages, a drum of hard rubber was built on the squirrel-cage pattern. The film is passed in a loop around this and over the transverse rod in the tank, and the two ends are pinned together so as to form a continuous belt. The height of the drum can be adjusted to suit the length of the film. In developing, the drum is merely turned by means of the handle shown in the figure. The operation is perfectly simple, and the apparatus is quite free from all complicated features.

It is one of the drawbacks of the daylight developing tank, that it requires an undesirably large amount of developer. The apparatus here described is free from this objection, owing to the shape of the Ingento tank. It is, of course, intended for dark-room developing, and was primarily designed for use by the



A film-developing machine.

students working in the photographic laboratory.



Figs. 1, 2, and 3.—Diagrams showing the three modifications of the Ruhmer system.

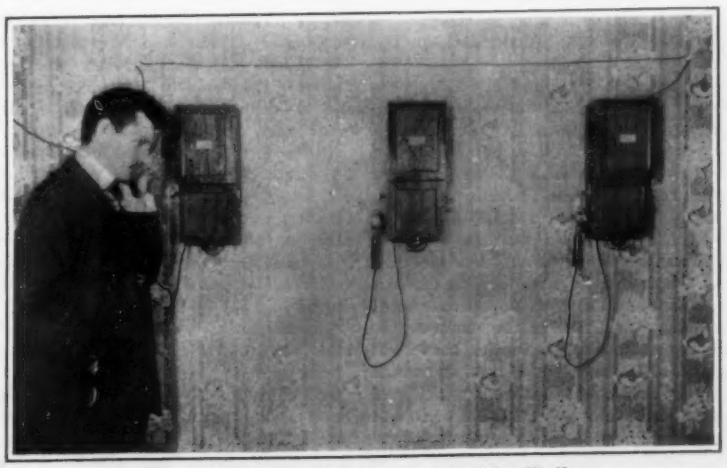


Fig. 4.—Three receiving instruments with callbells.

RUHMER'S SYSTEM OF MULTIPLEX TELEPHONY

The Ruhmer System of Multiplex Telephony

ERNST RUHMER of Berlin has developed and patented a system of multiplex telephony which closely resembles the system which Major George Owen Squier, of the United States Signal Corps, has invented and presented to the public, as was narrated in the SCIENTIFIC AMERICAN of January 21st, 1911.

The Ruhmer system is very clearly and succinctly described in the French patent, issued September 16th, 1910, from which the following description is adapted.

The invention relates to a method of transmitting several telephonic messages simultaneously over a single wire. The messages are transmitted by means of alternating currents of high and different frequencies, analogous to those employed in wireless telephony. These currents are superposed on the line wire and are separated at the receiving station, where each current acts upon a special receiving apparatus, through the agency of an oscillatory circuit attuned to the pitch of the oscillatory circuit which produces that current at the transmitting station. In this system the different receiving circuits are inductively connected with each other and the line in a comparatively loose or weak manner, in order to obtain a perfect separation of the messages and to assure the proper reception of the feeblest of them, thus preventing confusion in the case of simultaneous transmission of a large number of messages.

Three modifications of the system are shown in the diagrams. In Fig. 1, three synchronized pairs of transmitting and receiving apparatus are denoted by A, A_1, B, B_1, C, C_1. The high frequency current is produced by a generator of known type, for example, an electric arc G connected in parallel with an oscillatory circuit $C L$, the frequency being regulated by the values of the capacity C and the inductance L. The intensity of the high frequency current is affected by the microphone m, which may be bridged across the terminals of the inductance coil L (as in the third apparatus C_1), or of an auxiliary coil in the oscillatory circuit (as in B_1), or may act inductively

on the feed circuit (as in A_1). In general, any method which prevents each microphone from affecting any transmitting circuit except its own may be employed.

At the receiving station each high frequency current produces resonance in a synchronized oscillatory circuit $C' L'$, and thus acts upon the telephone receiver T by means of the detector D, as in wireless telephony. Two arrangements of the detector, telephone and oscillatory circuit, are shown in A_2 and B_2, but the detector may be omitted and the messages received directly by a Foucault current W, as in C_2.

Fig. 2 shows a simplified apparatus which does not include any special device for producing high frequency currents. Speaking into the microphone m generates in the oscillatory circuit, composed of the capacity C and the inductance L, trains of damped vibrations having a frequency equal to the pitch of the voice.

Fig. 3 shows an apparatus which can be used alternately for transmitting and receiving messages. The same oscillatory circuit is used for both purposes and is connected, by means of a commutator, with the microphone m and the battery, or with the detector D and telephone T, as desired. The commutator may be so constructed that it also modifies the inductive connection of the inductance L with the line F, making the connection closer or stronger for transmission and looser or weaker for reception.

The accompanying photographs (Figs. 4 and 5) illustrate a set of transmitting and receiving apparatus which was sent to the Brussels Exhibition last year, but was not exhibited because of the fire which so greatly injured the exhibition. In this apparatus the electric oscillations are generated by Poulsen arcs. Only three pairs of instruments were employed because the apparatus was designed merely for demonstration. The instruments worked well, without interfering with each other. Herr Ruhmer writes that he has used his apparatus with success on ordinary telephone circuits with wire return. He adds that the first idea of multiplex telephony occurred to him early in 1907, and is mentioned in his book on wireless telephony, published in that year. The first demonstration of his system was made in November, 1908. He applied for the French patent on April 5th, 1910, and for the Belgian patent still earlier, on March 16th, 1910.

Progress in the Aluminium Industry

IN a circular issued by the United States Geological Survey, W. C. Phalen makes some very interesting statements, which are reproduced below:

RECENT PATENTS.

In consequence of the great demand for the metal the Aluminium Company of America made extensive additions to its plant equipment in 1907. This great increase in plant capacity was followed by the business depression of the fall of 1907, as a result of which there have been few new developments to record since the beginning of the year 1908, the completion of projects already under way excepted. In the matter of invention, however, the aluminium industry has kept pace with its former records. Perhaps the most interesting recent inventions are a group patented in December, 1908, by F. J. Tone, superintendent of the Carborundum Company's works at Niagara Falls, which have for their object the production of silicon from kaolin and the formation of pure alumina as a by-product. Calcined kaolin (clay) is mixed with carbon in the electric furnace. Under proper regulation of the heat, the oxygen of the silica becomes absorbed, which results in the production of elementary silicon; iron oxide, if present, is reduced to metallic iron; and titanium oxide is reduced to metallic titanium. The alumina thus purified from metallic oxides remains behind unreduced. If iron is mixed with the charge, ferrosilicon is obtained. The reactions reduced to their simplest forms are as follows:

$$Al_2O_3, 2SiO_2 + 4C + Fe = Al_2O_3 + FeSi_2 + 4CO$$

and

$$Al_2O_3, 2SiO_2 + 4C = Al_2O_3 + 2Si + 4CO.$$

According to Tone, the silicides produced in this process are useful for various purposes, such as the refining of iron and steel, and the alumina is useful both as an abrasive and also as an ore for the production of metallic aluminium. Thus the way appears to be opened for the production of metallic aluminium from kaolin or clay, a goal that has been long sought by many experimenters.

RECENT APPLICATIONS OF ALUMINIUM.

Recent progress in the application of aluminium in the industries has been summarized by Joseph W. Richards. He gives an account of the use of metallic aluminium in aluminium coins, in aluminium paper, and in aluminothermy in making alloys and bronzes. He also devotes some attention to welding processes in which aluminium is used, and to miscellaneous uses of the metal.

Aluminium is used in iron and steel works for removing oxygen from the oxides of iron and other substances, the heat generated being so great as to raise the temperature of large bodies of iron. It also has the power of combining chemically with those gases imprisoned during the cooling of the metal, thus preventing porosity. For these purposes the metal is either used in the form of an alloy known as "ferroaluminium," or as the pure metal, either in the granulated or bar form or in small pieces weighing uniformly one-eighth or one-fourth of an ounce each. This property of keeping molten metal hot or of raising the temperature of a molten metallic bath has been utilized in the thermit welding process, invented by Goldschmidt. In this process aluminium and iron oxide are intimately mixed in a finely divided state and ignited by means of a fuse. The heat of combustion in the ensuing reaction raises the temperature of the casting to the welding point. The reaction takes place in a funnel-shaped crucible, from which the fluid metal resulting from the reaction is run into a suitably shaped mold formed around the area of the joint to be made, which is preheated by means of a blow lamp to avoid chilling the first lot of metal coming through.

Aluminium is used in constantly increasing quantities in the motor-car industry, combining as it does both lightness and stiffness. It is used in making crank cases, gear boxes, carburetors, radiators, dashboards, etc., besides in smaller ways. Its use in this comparatively recent industry is of interest, and especially so is its application in the newborn art of aviation, where the same qualities of lightness and stiffness again recommend it.

In castings it has been found advantageous to alloy the metal with copper, zinc, or nickel, which increases its strength and makes it easier to work. The prevailing low prices of ingot aluminium have resulted in a greatly enlarged demand for the metal for such work. The principal demand for such castings has come from automobile builders. The users of brass castings, especially the manufacturers of electrical apparatus, have been gradually changing from brass to aluminium castings, and for some purposes aluminium castings have been substituted for iron castings. The use of zinc for hardening purposes has been condemned by some writers, but according to Jesse L. Jones this condemnation is unwarranted. According to this writer, "where cost is not of primary importance, where castings must be bent, and where the alloy must be as light as possible, copper-hardened aluminium should be used; but where a moderately light alloy is satisfactory, where castings do not have to bend, where low cost of production is essential and a high tensile strength is desirable, properly made aluminium-zinc alloys leave little to be desired."

Aluminium is one of the most malleable of all metals. Moreover, it takes and retains a very high polish. For these reasons it is used in connection with the manufacture of articles of everyday use almost without limit. Some of these new uses are as wall "paper," ceiling panels, stamped or hammered trays, finger plates, etc., in the form of very thin sheets; as a substitute for lithographic stones and zinc plates; and in the panels of car and carriage bodies. The advantages of aluminium in the manufacture of cooking utensils are well known; among these advantages are long life, non-corrosion from acids, and lightness.

In the form of powder aluminium is used to an increased extent in the manufacture of metallic paints and varnishes, its property of not tarnishing making it particularly suitable for this purpose. The paint is valuable in protecting iron and in rendering woodwork partly fireproof when applied in thick coats.

In the form of tubes it is used by acid and rubber manufacturers. A new product is bimetallic tubing, which is made of aluminium and steel, with the outer sheet of aluminium and the inner of steel, or *vice versa*. The same combination may be made with aluminium and copper.

The subject of the alloys of aluminium is so vast that it can only be briefly referred to here. Great strides have been made in the study of this subject in recent years. The alloys in most common use are those of aluminium combined with zinc, copper, and nickel. A new alloy which has attracted some attention is known as magnalium. As prepared by Dr. Ludwig Mach, 2 to 12 parts of magnesium added to 100 parts of aluminium produce an alloy lighter than aluminium and possessing the workability and strength of brass. One of the most valuable features of the alloy is the ease with which it can be turned, planed, or drilled.

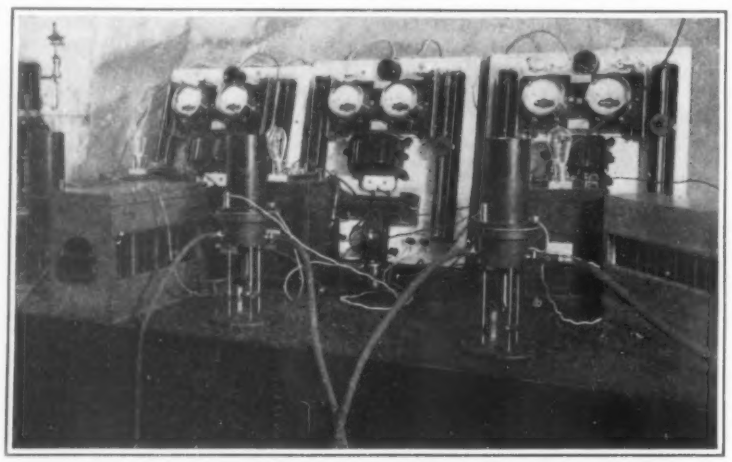


Fig. 5.—Three transmitting instruments operated by Poulsen arcs.

RUHMER'S SYSTEM OF MULTIPLEX TELEPHONY

Legal Notes

February 29th, 1910, is Impossible.—According to mathematics as taught in the little red school house, 1 day equals 24 hours, but for defendants in the cases of McGinsey v. State and Nobles v. State, 132 Southwestern Reporter, 773, 1 day equals 41 years for McGinsey and 40 years for Nobles. So authorities differ. They were each convicted of robbery, and given, respectively, 40 and 41 years in the penitentiary; but because the man who drew up the indictment had not committed to memory the old adage, "Thirty days hath September," etc., they appeal, for the indictment alleges the offenses to have been committed on February 29th, 1910. The Court of Criminal Appeals of Texas holds that this is an impossible date, and is not a sufficient allegation of time to comply with the statute, which requires that there shall be some particular date mentioned. The prosecutions were dismissed.

X-ray Evidence.—According to the West Publishing Company's "Docket," a new use has been found for the X-ray machine. In the case of Browder v. Commonwealth, 123 Southwestern Reporter, 328, it seems a negro was on trial for shooting and killing a white man. He did not deny the shooting, but claimed he shot in self-defense. The deceased after the shooting had a pistol. Defendant claimed that he had been shot in the breast by deceased, which was the beginning of the difficulty. It would necessarily follow that if defendant was shot, and if he could affirmatively prove it, then a case of self-defense would be clearly established. Accused moved for a continuance in order that he might be examined with the X-ray by a physician to show that he was shot in the breast and that the bullet had lodged in his back. The court on appeal held that defendant on return of the case might be taken from jail to an X-ray machine and examined; for this fact, if proved, would strengthen his testimony as to what occurred at the time of the homicide.

The Spearmint Trade Mark in Court.—In the case of William Wrigley, Jr., v. Grove Co., 183 Federal Reporter, 99, it was decided that the word "Spearmint," applied to chewing gum was a term descriptive of flavor, open to every manufacturer who used such flavor, and cannot be appropriated as a trade mark. The Wrigley Company for at least five years has been selling this gum, which has become popular through advertising. The defendant company lately placed upon the market a similar gum called "Spearmint," imitating the other's labels and boxes, and thus secured a portion of the profit from the vast demand for "Spearmint" gum. An injunction was prayed for. The Circuit Court of New York held that, although complainants were not entitled to a trade mark in the word "Spearmint," defendants in imitating the cartons and packages were chargeable with willful and intentional unfair competition. This may have been a blow to defendants, but the iron heel of the law strikes many more, for the court says: "It is well known that the gum-chewing community is not, as a class, drawn from the most intelligent and discerning portion of the public. The proof shows that in the city of New York the majority of customers come from the East Side, and is largely composed of ignorant foreigners, many of them unable to speak our language. That such customers may be induced to purchase the defendant's gum for the complainant's is more than probable." Gum

chewers may well revolt and cry out as with one voice, "This was the most unkindest cut of all." An injunction was granted.

The Pneumatic Tire in 1847.—An early instance of the pneumatic tire is found in a United States patent issued May 8th, 1847, to one Thomson, of Adelphi, County of Middlesex, England. To an ordinary wheel he added what he terms a belt including an inner casing of canvas saturated with rubber and sulphurized, and a strong outer casing. The tire was preferably distended with air, through a pipe fitted with an air-tight screw cap, this construction following closely the filling tube of the ordinary pneumatic tire of to-day with the tube extending inwardly through the wheel felloe. At that early day Thomson suggested that the belt or tire might be distended with metallic spring, sulphurized pieces of caoutchouc, horse hair, or sponge. He also describes a wheel having a series or cluster of smaller circumferential tubes inclosed in an outer casing. As another modification he describes and illustrates a tire in which the tube is divided transversely with a number of separate air-tight compartments, each section having its own individual filling tube. In mentioning the advantages of his construction, Thomson referred to the small amount of power requisite to propel a vehicle equipped with the pneumatic tires, the absence of jolting and consequent lessening of injury to machines, absence of noise, high speed attainable and gentle motion resulting from the use of the new construction.

A Patent Lawyer's Eloquence.—In one of the telephone cases back in the eighties Mr. Edward N. Dickerson, of counsel for the company and one of the ablest patent attorneys of his day or any day, delivered an interesting argument, the printed record of which covers over two hundred pages and is as readable as a romance.

Referring to one of the opposing counsel, he says:

"There is a maxim among the Orientals—'To know that you know what you know; and to know that you do not know what you do not know, that is knowledge.' My distinguished friend has evidently studied that maxim with care; and he has made great progress in the latter half of it. He *knows* that he does *not know* a great deal; and if he should in the future make equal progress in the former half of it, he will be able to present himself as the embodiment of knowledge. But thus far he has not studied that; and whenever he departed from the safe negative side he made a mistake. With the liberality which belongs to a generous nature, he did not wish to deprive anybody else of a share of the happiness of ignorance; for he told you that none of the rest of them know any better than he did, which at least was generous to them."

At one point he pays this eloquent tribute to invention and inventors:

"A century had passed since this country was a wilderness; and it had become a garden, inhabited by fifty millions of people, whose success and prosperity had depended upon the inventive genius of man. The few feeble hands that came to these shores were reinforced and had become millions because of the strength given to them by the inventions that the men of genius had furnished them—inventions which never would have been made but for the encouraging influence of the patent laws. The great prairies of the West which, when they are tickled, smile with a ripple of golden grain, were made to smile ten times more sweetly by the McCormick reaper. The waste product of the worthless cotton plant had been coined into gold—converted into delicate fabrics and into the cotton shirt, the great civilizer of man, by the genius of Whitney and of Arkwright, and hundreds of others."

Notes for Inventors

The "Pulmotor."—There has recently been on exhibition in the office of Dr. J. A. Holmes, Director of the Bureau of Mines, an apparatus of German origin called a Pulmotor. It is designed for use in resuscitating persons whose lungs have been filled with noxious gases or water. Wonderful results are credited to it, an instance being cited where three men who had been repeatedly passed upon as dead were restored by its use, and in another case the Pulmotor did not reach the scene of a terrific mine explosion until twenty-six hours after the accident, and still was successfully used to save a man found near the mouth of the mine and who showed only slight bodily warmth.

The Flying Machine in Agriculture.—The credit of first utilizing a flying machine as an aid to agricultural pursuits is claimed for Thomas Hitchcock, a farmer in the vicinity of Aiken, S. C., who was recently carried by Aviator Coffyn in a flying machine from Aiken to his plantation, about sixteen miles away, and after attending to the business requiring his attention, returned in the same manner.

A Queer Use for Concrete.—A somewhat novel use for reinforced concrete is found in a French patent of July 24th, 1906, which employs the medium in producing a tire for wheels. The patentee claims that it presents a very hard surface and has a resiliency about equal to that of steel.

Vacuum Cleaning, an Old Idea.—It is not unusual for a rapid commercial development of an art to follow a long period of quiescence, and in few cases is this illustrated better than in the vacuum carpet cleaners, so popular at this time. More than fifty years ago a patent was granted to Daniel Hess of West Union, Iowa, for a carpet sweeper in which as it is rolled over the floor a bellows operates to create suction, draw dust up from the carpet and discharge it into pans of water, the bellows being worked from a crank on one of the supporting rollers. More interesting, in view of recent developments in the hand operated vacuum cleaners, is that shown in a patent issued in 1869. This cleaner closely resembles those marketed to-day in that it has a broad flat nozzle to move along the floor, a handle extending up to be grasped by one of the operator's hands, while the other hand turns a drive pulley geared by a rope with a fan which sucks the dust up into a receptacle carried by the handle above the fan. A machine following this plan of more than forty years ago, if well made mechanically, would present a good appearance alongside of the modern machines, and doubtless would give good results in actual use.

A New Process of Refrigeration.—Improvements in refrigeration, which are of especial interest to chemists, form the subject of a number of patents to W. W. Seay of San Francisco. Two papers on the subject were read before the American Chemical Society at its December, 1910, meeting at Milwaukee. In carrying out the process the expanded ammonia gas is combined after refrigeration, with two bodies of a solid absorbent contained in separate tanks, a portion of the ammonia being heated and volatilized from the solution under compression in the first tank, and the gas delivered into a condenser, the other tank being cooler and under low pressure and the residue of the ammonia from the solution in the first tank being delivered into the said second cooler tank and the process reversed similarly to the process followed when liquid absorbents are used in separate tanks. The solid absorbent specified is such as sulpho-cyanide of ammonium—NH_4CNS—or ammonium nitrate —NH_4NO_3. It is claimed that by this process a considerable saving is effected both in the heat required to drive off the ammonia from the solution and in the cooling water for the condenser.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

The weekly *Index of Patents* issued by the *United States Patent Office* will be found in the *Scientific American Supplement*.

Pertaining to Apparel.

SWEAT BAND FOR HATS.—B. Z. SMITH, Mountain Home, Idaho. The object of this invention is to provide a band, especially adapted for men's hats of any type, which will permit the top of the head to be ventilated, and will not shut off the flow of blood to the scalp, the band engaging the head at a number of separated points, instead of in a continuous band.

Electrical Devices.

ALTERNATING CURRENT PLANT COMBINED WITH STORAGE BATTERY.—L. SCHRÖDER and A. MÜLLER, Berlin, Germany. The invention has reference to alternating current plants combined with storage batteries and has the purpose to regulate the charging and discharging of the storage battery in such a manner that if the current used in the plant varies the main motor actuating the main generator is working with constant load.

Of Interest to Farmers.

COTTON CHOPPER.—J. J. CROW, El Paso County, Texas. The invention provides a cotton chopper adapted to be used to cultivate the soil previous to planting cotton or the like, or the device can be readily used to chop down rows of cotton stalks or the like, the means for chopping off the stalks being adjustable so that the stalks can be severed at various distances above the ground.

BEEHIVE.—S. BLAGG, Erie, Ill. The board separating the brood chamber from the supers is provided with a supplemental bee-passage, which may be instantly opened or closed by means of a device operated exteriorly to the hive. The other bee-passage with which such separating board is provided is also furnished with means for allowing escape of bees or for completely closing the same as conditions require.

VERMIN EXTERMINATOR FOR POULTRY.—W. F. CRAWFORD, Colorado, Texas. The apparatus includes a cup—or can—like holder for the oil or other liquid used as the insecticide, a perforated conveyor into and from which the liquid is delivered, and a fibrous distributor with which fowls come in contact as they pass in or out. The liquid holder is provided with a valve for regulating discharge into the conveyor, and the distributor is preferably formed of cotton strands that are hung from a pivoted rocking device in which they are clamped.

Of General Interest.

COLLAPSIBLE FUNNEL.—A. L. HARRINGTON, Hooker, Okla. This funnel is adapted for conducting various materials, the same being formed of telescopic parts, so that it may be adjusted to occupy minimum space for storage or transport. It is provided with an attachment in the form of a skin or fabric suitable for filtering liquids, whereby the funnel is particularly adapted for use in straining gasoline or other liquid hydro-carbon used in motor vehicles.

FILLING DEVICE.—F. WENDLING, New York, N. Y. In the present patent the invention has reference to devices for filling liquids into kegs, barrels and other receptacles, and the object is the provision of a new and improved filling device, arranged to give an alarm or to shut off the supply of liquid as soon as the receptacle is properly filled.

WATER DISTRIBUTING SYSTEM.—H. E. MARTIN, Colorado Springs, Colo. The invention provides a means whereby water may be raised from a well or other receptacle without necessitating the employment of a pump in a well; to provide means whereby the flow of water may be controlled to produce instantaneous effects as when influenced by a water head.

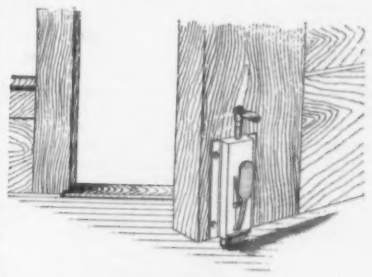
Hardware and Tools.

STEEL TAPE MEASURE.—K. G. SHUTT, Warren, Pa. The object of this invention is to provide a simple and cheap attachment for use on winding tape measures, which will hold the required length of tape drawn out, preventing its return, and also preventing the withdrawal of more line until released. The improvement may be applied to existing tapes of any kind, whether of steel or of cloth.

STRETCHING APPARATUS.—C. J. GAUER, Morristown, and J. GAUER, Dover, N. J. This invention pertains to apparatus for stretching the leather of shoes, or for performing like operations upon other material and has reference more particularly to apparatus comprising relatively movable members, means for clamping the same together, jaws carried by the members and adapted to grip the material there between, and a presser for stretching the material gripped between the jaws.

DOUBLE ACTING SPRING HINGE.—O. KATZENBERGER, Chicago, Ill. In this hinge the tension on the spring bolt is obtained by a thrust in axial alignment therewith, instead of a thrust at the side or oblique thereto, as in the usual practice, thus reducing friction, the friction being further reduced by providing between this bolt and the operating cam, a roller, the latter also arranged to successively engage in a number of recesses in the operating cam and firmly hold the door until pressure is brought to bear thereon, in closed and open positions.

DOOR CHECK.—JOHN H. YOUNG, Kingsbury, Ind. The engraving shows a device which is for use for closures such as doors, to retain a door in a desired position. For this purpose use is made of a casing for attachment to a door, a plunger mounted to slide in the casing and adapted to extend therefrom, a pawl for



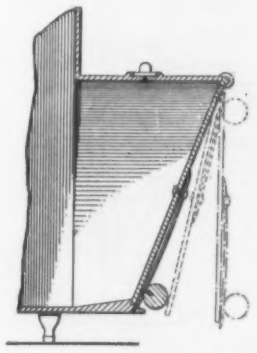
DOOR CHECK.

engaging with the plunger to retain the same in the casing, a spring for moving an end of the plunger outwardly from the casing when the pawl is released from the plunger, a resilient pad secured to the bottom end of the plunger, means for limiting the inward movement of the plunger and a guard plate for attachment to the casing to prevent injury to the closure by the plunger.

Heating and Lighting.

FURNACE DRAFT OPERATING APPARATUS.—W. H. SCHUBERT, New York, N. Y. The inventor provides an apparatus for opening and closing dampers of a furnace and a time actuated mechanism for releasing the same; provides a time actuated mechanism for releasing suitable devices for opening and closing the damper drafts of a furnace having a tripping mechanism simplified in its operation; and provides means for mounting a time releasing mechanism in convenient position upon a furnace.

DAMPER.—JAMES M. SPRIGGS and GEORGE W. FOGELSONG, Dee, Oregon. In the present patent the invention has reference to draft regulators, and more particularly to dampers for furnaces and the like as shown in the accompanying illustration, and has for an object to provide a damper adapted to automatically



DAMPER FOR FURNACES.

regulate the draft for a furnace or a stove. For the purpose mentioned use is made by the inventor, Mr. Fogelsong, of a closure dependent from a knife edge, and means on the closure for adjusting the angle of dependence of the closure or for removably securing the closure to a flue or like member.

Household Utilities.

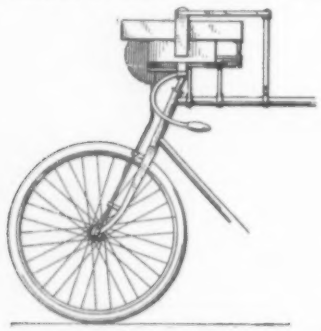
FOOD MOLD.—S. B. LJUTICA, Portland, Ore. Among the principal objects here are: To provide means for ejecting the article from the mold after the same has been shaped; to provide an apparatus for molding raw food preparatory to cooking the same, which is convenient, simple and efficient in operation; and to provide a mold economical in construction.

MEANS FOR OPERATING WALKING BEAMS OF DEEP WELL PUMPS AND DRILLS.—G. M. BRADRICK, Portersville, Cal. The invention is a cam lifter for so-called walking beams to which the piston rods of single and double-acting deep well pumps and the rods of drills in well-boring rigs are attached. In such apparatus, a slow upward movement and quick return of the piston or drill is desired, and this is attained without jerk or jar of operating parts, the apparatus working smoothly and practically noiselessly.

BALANCING GEAR FOR AIRSHIPS.—H. M. DEGRAW, Camden, N. J. The invention provides means operable by the aviator for varying the wing flexure of aeroplanes; provides means for varying the extent of the flexure and for connecting the same with the tiller device; and provides means for adapting the wing warping flexure or ailerons to the operation of the steering rudder.

GRINDER ATTACHMENT.—J. M. JENSEN, and E. C. LEBLANC, Bowie, La. The improvement provides an adjustable, spring-actuated tension device to relieve the pressure on the grinding wheel when the same exceeds the calculated strain and provides a tension device for the mandrel of the grinder head which is simple, efficient and durable in construction.

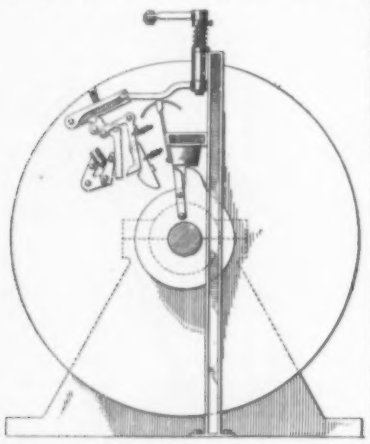
AUTOMATIC MAPPING MACHINE.—MIGUEL BUSTAMANTE, and ALCUIDADO DE GUILLERMO BUSTAMANTE, Imprentadi de Telegrafos Federales, Mexico, Mexico. Among the principal objects this invention has in view are: To provide a machine which may be attached to a moving vehicle to automatically plot on a horizontal plane the path traveled by the vehicle, and the gradients and altitudes of the path so traveled; and to provide a machine which is compact in size and form, and durable and simple in construction. The illustration is that of a machine which may be applied to any character of vehicle. Whether used in con-



AUTOMATIC MAPPING MACHINE.

junction with a bicycle, automobile, or other vehicle, if the same turns with the wheel, is fixedly mounted one of a pair of gears, equal or different in the number of teeth carried thereby, as desired.

INTERMITTENT DRIVING MECHANISM.—ANTON E. H. J. THOELLDEN, 109 Foster St., New Haven, Conn. In the present patent the invention shown in the accompanying engraving is an improvement in intermittent driving mechanisms for use in machines in general, and it has in view a rotary driving member



INTERMITTENT DRIVING MECHANISM.

and a rotary driven member mounted closely adjacent, with the driving member having a driving dog pivoted thereto to swing into engagement with the driven member, and a mechanism to lock the dog in operative position, respectively released from and engaged with the dog at predetermined periods by independent devices.

FEEDING ATTACHMENT FOR SLUG OR TYPE CASTING MACHINES.—J. G. RAUCH, Slatington, Pa. The invention provides means for delivering pigs of type metal to the melting pot at intervals coincident with the withdrawal therefrom of quantities of melted metal equaling in weight the said pigs; provides means whereby adjustment may be varied to suit the action of the casting machine; provides a construction whereby the feeding mechanism may be removed from over the melting pot and provides means whereby the metal may be delivered into the melting pot without splash of the molten metal therein contained.

LOOM SHUTTLE.—W. H. WILSON, New Bedford, Mass. More particularly the invention relates to the construction of the thread-engaging and delivering portions of the shuttle. Mr. Wilson's improvement is applicable to the ordinary type of shuttle in which a bobbin is supported within an opening in the body of the shuttle so as to deliver the thread off the end of the bobbin and through a delivery eye in the side of the shuttle.

TRAP.—L. C. ACCOLA, La Grange, Mo. The invention relates more particularly to mechanical traps and provides a quick-operating mechanical trap for trapping animals, particularly quadrupeds. For the purpose mentioned, use is made of a coiled wire spring having ends extended from the spring and crossed, one over the other, a trigger wire mounted on the spring and engaging the trigger, and guide wires engaging the trigger and the crossed ends at the point of crossing.

Railways and Their Accessories.

STREET CAR FENDER.—J. J. KELLY, New York, N. Y. The principal object of this improvement in street car fenders is to provide a mechanism therefor, whereby the fender may be lifted to a position of safety, under certain conditions of operation of the street cars, and be released from such safety position to an operative or life-saving position.

SNOW MELTER.—W. J. SAXON, Paterson, N. J. This invention relates to certain improvements in devices adapted for use upon locomotives for melting the snow or ice from the track in advance of the locomotive. The invention is so constructed as to use the steam from the locomotive, and to deliver the steam to the track in the form of a flat stream or sheet.

CAR TRUCK.—C. A. LINCOLN, Wayne, Me. This invention provides trucks for railway cars constructed and arranged to dispose the axles of the wheels thereof in radial position upon curved sections of a track; and provides means for balancing the swing of the axles of a four-wheel truck when the same are adjusted to track on a curved section of the road bed.

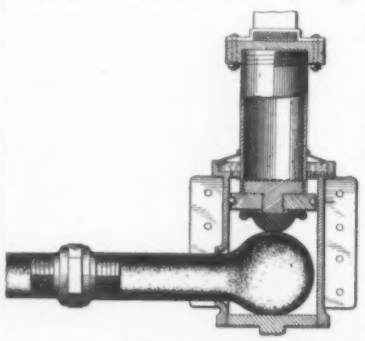
Pertaining to Vehicles.

SHOCK ABSORBER.—J. M. JACKSON, Parkersburg, W. Va. The intention here is to produce a simple, cheap and efficient device which can be applied to any automobile to act as an auxiliary to the ordinary spring gear to render the shocks or jolts practically negligible when traveling at high speed and under normal conditions of travel.

TIRE.—V. O. MERVINE, Stroudsburg, Pa. This invention is an improvement on resilient tires for use on the wheels of motor cars and similar vehicles. A feature lies in the ribs being arranged diagonally to the circumference of the tire and the tread surfaces and the spaces intervening the ribs are curved, with the lines of the recesses and of the ribs united by gradual curves, thus securing the greatest resilience and avoiding angles that cause fracture of the rubber by the flexion of the ribs.

WHEEL.—V. O. MERVINE, Stroudsburg, Pa. This invention is an improvement in wheels for use on automobiles and similar vehicles. Means provide for holding the tire when it is molded within the tire carrier. When the tire is molded in the carrier, it will be firmly held thereto as against strains in various directions such as are exerted ordinarily upon automobile wheels in the operation of such machines. The construction affords considerable elasticity in the use of the tire with the minimum weakening effect upon the tire.

VEHICLE SPRING.—CARLOS ESCALANTE, and JOSÉ P. SIRGADO, 342 West 23rd St., New York, N. Y. The object of the invention illustrated herewith is to provide a pneumatic spring for connection with the axle of a vehicle, to provide the same flexibility as pneumatic tires; to secure the same on vehicles having solid tires so that the vehicles will be free of jars or shocks and to reduce the friction of the wheels of the vehicle with the pavement. The improvement can be easily applied to bicycles, replacing the spiral spring now used by



VEHICLE SPRING.

some makers in the upper end of the rear fork. The tube now enclosing the spring may be made a little larger in diameter and cover the air chamber, and the reservoir can be neatly placed right under the seat, connecting it with the chamber with flexible piping.

WHEEL WITH MULTIPLE AND BALANCED RIMS.—H. LOTTE, 4 Rue Matha, St. Jean d' Angély, Charente-Inférieure, France. This invention relates to a wheel with multiple and balanced rims, and the arrangement of the rims has for its purpose: To facilitate the passing of obstacles, each rim being capable of being separately displaced to pass these obstacles; to considerably diminish the height of the displacements transmitted to the hub of the wheel when running on uneven ground; and to diminish jars.

HYDROMOBILE.—M. W. TEBYRIÇÁ, Sao Paulo, Brazil. The invention comprises essentially an endless series of pontoons or air-tight tanks, which are adapted to co-act with one another to afford a support for the structure as it passes over shallow water, or even across bars of sand. An object is to provide the hydromobile with tanks which will afford the maximum amount of buoyancy, and also be so formed that the upward pressure will not tend to distort the lower line of tanks and cause unnecessary friction.

TIRE.—W. D. FUREY, Norfolk, Va. The object of the present invention is the provision of an inexpensive resilient tire for use in automobiles and like vehicles, which will closely resemble the pneumatic tire and provide a sufficient degree of resiliency without any possibility of damage from puncture.

Designs.

DESIGN FOR A TOY FIGURE OR LIKE ARTICLE.—CORNELIA A. HOPKINS, New York, N. Y. This ornamental design for a toy figure is particularly attractive from its grotesque construction of form and features and ornamentation in angles exclusively. The design is unique and calculated to draw immediate attention.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12419) E. C. M. asks: Will the mode of cleaning silver in Query 12355 affect plated silverware and eat off the plate? It is a simple way of cleaning if safe and not injurious to the articles. A. The electrolytic method of cleaning silver removes a layer of infinitesimal thickness each time it is employed, but so also does the use of any polish by rubbing. If the boiling is not prolonged beyond the removal of the stain, it is probable that less metal will be lost than by use of a polish.

(12420) A Subscriber since 1860 writes: To get a tight cover off a round tin box—of blacking, tooth powder, tobacco, and the like—do not touch the cover, but tap on the side of the box itself close to the cover with a small hammer or the equivalent, going round and round. By the second or third time round the cover will be loose enough to fall off. It is rather curious to watch it rising as you turn and tap.

(12421) C. R. S. writes: I would like to know if the experiment has ever been tried of connecting the ends of U-shaped transparent tube to an animal artery in such a way that the blood would flow through the transparent tube back into the artery and take its usual course through the animal body, the tube for a time to become part of the artery, the purpose of the experiment being to determine what effect sunlight would have on disease germs floating in the flowing blood in the transparent tube. It would seem that this might be tested on animals by some well-equipped medical institute, and much might be learned of the effect of sunlight on the germs of consumption and other diseases; and even if the germs were not floating in the blood, the light might affect the blood in such a way as to destroy the germs in the animal tissues. This thought occured to me after reading the article "The Physiology of Light" in the SCIENTIFIC AMERICAN SUPPLEMENT of December 24th, 1910. A We are not aware that the experiment which you suggest has ever been tried. There are several obvious objections which suggest themselves to the applicability for medical purposes of any such method. We could at best expect to reach only a very small proportion of the germs causing the disease, the bulk of them being in most cases naturally more or less permanently located at the seat of the trouble. The action of sunlight on germs is probably quite direct, and it does not seem likely that the mere exposure of the blood to sunlight would indirectly have such influence upon germs situated in some other part of the body. Nevertheless, in this, as in all questions of science, the only absolutely conclusive test is actual experiment.

(12422) J. T. S. asks: Will you please tell me by way of Notes and Queries page what is the per cent of salt in the Dead Sea? Also, what is the per cent of salt in the Great Salt Lake, Utah? We want to find out which is the saltest body of water in the world. A. So far as is known, a lake in Russia is the saltest body of water on the earth. The Great Salt Lake in Utah is next, and the Dead Sea in Palestine is the third. Recent figures of the amount of solids in the waters of various lakes and seas are as follows: Irish Sea, 3.386 per cent; English Channel, 3.525 per cent; Mediterranean Sea, 4 per cent; Dead Sea, 22.857 per cent; Great Salt Lake, 27.068 per cent; Elton Lake, Russia, 27.143 per cent. The figures for the Great Salt Lake are probably higher than the average for that body of water, since the saltness varies with the amount of fresh water which enters the lake during a season. These figures were obtained in 1907, and are said to be the record figures for the lake.

(12423) T. J. M. asks: Please explain in full how much water will pass through a straight 10-inch cast-iron water pipe in 24 hours, with a pressure of 150 pounds. A. The law of flow of water in pipes is very complicated, and no simple formula exists which expresses it. One of the best approximations is Kutler's formula, which involves the diameter, head, length of pipe, and a coefficient of roughness. When the coefficient of roughness is carefully selected, the result calculated from the formula will be probably not more than 7½ per cent in error. As you give only diameter and pressure, we are quite unable to make the calculation, not knowing length of pipe or its condition as to surface, joints, straightness, etc. If the pipe were a short sleeve, say a foot long, you could use the simple formula $v^2 = 2gh$, which in this case gives: $v^2 = 2 \times 32.2 \times 150 \times 2.3 = 22,200$; and $v = 149$ feet per second. This theoretic velocity is for water falling freely, and must be reduced to allow for the contraction of the stream as it enters the pipe; probably 110 to 120 feet would be the limit realized in practice, which indicates:

$$110 \times \frac{78}{144} \text{ square feet area} \times 60 \times 60 \times 24 = 5,160,000$$

cubic feet per 24 hours through the short 10-inch sleeve or nozzle.

(12424) M. W. D. asks: We have two boilers, 125 horse-power each, carrying from 60 to 80 pounds pressure for heating purposes. Our feed water is cold. If we tap the feed pipe and put in live steam at boiler pressure to heat the water, will it effect a saving of fuel? A. You cannot save fuel, generally speaking, by heating feed water by live steam from the boiler. Sometimes feed water contains impurities of a nature which will be deposited when the water is heated above 212 degrees, and live steam may then be used to advantage to purify the feed water and cause the solids to drop out in the heater instead of in the boiler. With a plant of boilers for steam heat only, such as yours, the only possible economy in fuel water is to save and return all the hot water drops from the radiators. Feeding cold water into a hot boiler should only be done in such a way as to prevent the cold water from coming in immediate contact with the hot boiler sheets, with the consequent sudden and unequal contraction of those sheets, straining rivets and joints, often causing leaks and even cracks, and tending to deposit scale and mud and cause overheating of the metal so covered.

(12425) J. W. B. asks: I would be pleased if you would tell me something with reference to the substance known, I think, by the name of "selenium." This substance is one that is a conductor of electricity in direct ratio to the amount of light that is trained upon it. What I want to know especially is, first, where can I obtain some of this substance? Second, how is the light applied to bring about the different gradations or efficiency of the current; that is, is the light that is applied diffused or trained directly? Third, how sensitive is the substance with reference to its conductivity under the action of light? A. You will find in SUPPLEMENTS 1530, 1611, 1719, and in the SCIENTIFIC AMERICAN, Vol. 100, No. 11, the information you require about selenium. We send these copies at ten cents each. It is not in its ordinary condition a conductor of electricity, but almost an insulator. When a strong light is concentrated upon an especially prepared selenium cell, its resistance is reduced to a small part of what it was in the dark, and it transmits an appreciable current. It is used for scientific purposes now, but may be applied to practical uses at some future time. It is made sensitive by long heating to a point just below its melting point. The light used is generally an acetylene or strong electric light, so placed as to cast a strong beam upon the selenium cell. It has been used for wireless transmission in various ways.

(12426) W. L. asks: Will you kindly tell me at what point between the poles the needle of a compass turns from north to south? Is there a point between the north and south magnetic pole where the attraction is about equal in either direction, thus keeping the needle oscillating? A. At all points of the earth the magnetic needle is attracted and repelled by both poles of the earth. In your place the north magnetic pole of the earth attracts the north end of the needle and repels the south end with as much force as it attracts the north end. So too in your place,

the south magnetic pole of the earth attracts the south end and repels the north end of the magnetic needle in the same manner. Thus there is an exact equality of forces upon both ends of the magnetic needle. This is true of every place on the earth. There is no place between the magnetic poles where the needle turns around and points the other way, nor any place where it does not have a directive force. Everywhere the needle points between the two magnetic poles excepting over a pole itself, where it simply has no direction whatever. This of course does not take account of the declination or of the dip of the needle.

(12427) R. K. says: A circular reservoir is 100 feet in diameter, 12 feet deep, built of staves, encircled by a single hoop at one-third or thereabout of their height, the point where the pressure above and below will be equal. The tank is filled with water, and the whole bursting strain is sustained by the one loop. What will be the tensile strain on this loop? Also, what will be the strain if the tank is 50 feet instead of 100 feet in diameter? A. Imagine half the diameter of the tank to be filled with a solid block of wood or anything else. The pressure against this block will be the average pressure of the block

$$\left(\frac{6 \times 0.434}{2} \text{ or 2.6 pounds per square inch}\right)$$

multiplied by the area of the face of the block, 100×6 square feet or 86,400 square inches.

$$86{,}400 \times 2.6 = 224{,}640 \text{ pounds.}$$

Half of this pressure will fall upon each side of the tank, or the rod securing the staves, which must therefore be strong enough to withstand 112,320 pounds strain. If the tank is half as large, the strain will evidently be half as great.

(12428) W. B. G. asks: Why is it not possible to carry on an airship a powerful compressor, and compress the gas into drums as fast as it is expanded by the heat of the sun? During the night it could be allowed to flow from the drums back into the balloon, thus avoiding the waste of either gas or ballast. A. We suggest you calculate the weight of compressor and gas drums, and consider how much their pressure would subtract from the already limited carrying capacity for passengers and their belongings. A cubic foot of air weighs about 8/100 pound, so that 100 cubic feet of air, if compressed to 10 atmospheres or 135 pounds gage pressure, would occupy 10 cubic feet and weigh 8 pounds, and a cylinder to contain it at that pressure would be no negligible weight to carry on the airship. Balloon gas weighs somewhat less than air, but not enough to make its transportation in compressed form possible, to say nothing of the compressor.

(12429) W. C. G. says: I have often noticed when draining a vessel of water, where the drain is in the bottom and near the center of the vessel, the water starts to revolve around the opening through which it is passing, the direction of rotation being clockwise, or to the right invariably. It is more marked if the vessel slopes at the bottom. Is this due to magnetic lines of force? If so, our earth must be a huge dynamo. A. We have frequently had the statement made by correspondents that in a wash basin a rotary motion is always produced in the water as it runs out at the hole in the middle of the bottom, and that this motion is always clockwise. We are not able to subscribe to the "always," since we have noticed cases when no rotation occurred, and also when the rotation of the water was contra-clockwise. Many think that the usual clockwise motion is due to the rotation of the earth upon its axis, as is the case in the motion of rotation in an anti-cyclone, when the heavier air comes down from above and is forced out from the center, as in centrifugal motion. There is nothing magnetic about this phenomenon, although the earth may be a great dynamo. Water is not a magnetic material, and has no susceptibility to magnetic forces.

(12430) J. W. S. asks: Will you kindly quote to me the prices of several books on the subject of motors and dynamos? I want books that I can place in the hands of students of high school age, and that shall contain full directions for the design and size of magnets, armatures, etc., and for the amount and kind of wires. The motors and dynamos are to be of various sizes, from the toy size No. 1 horse-power, though I desire chiefly those ranging about 1/6, 1/4, 1/3 horse-power. A. We have published in the SCIENTIFIC AMERICAN and SUPPLEMENT plans for dynamos and motors of several sizes. Many amateurs have built machines from these plans and have used them for running sewing machines, etc., none of them being toys. We refer you to SUPPLEMENT Nos. 161, 162, 600, 641, 759, 761, 844, 1195, 1202, 1210, 1235, 1558, 1688, all of which we send for ten cents each.

(12431) H. A. B. asks: If a simple copper loop is whirled in an electric field at right angles to the lines of force, where is the point in the loop of highest potential, and why? A. The point in the rotation of a loop of wire in a magnetic field of highest potential is when the loop is parallel to the lines of force, and no lines of force are passing through the loop. For the demonstration of this see Carhart's "University Physics," vol. 2, pages 397 to 400.

NEW BOOKS, ETC.

STEAM TURBINES. **Their Design and Construction. By Rankin Kennedy. New York: The Macmillan Company, 1910. 8vo.; 104 pp. $1.25 net.**

The somewhat detailed table of contents may serve to indicate the scope of the book. Chapter I. Theoretical, Mechanical, and Physical. First Principles of Steam Turbines—Properties of Steam—Elementary Mathematics of Fluid Jets and Turbine Blades—Formulæ for Thrust Pressures and Velocities of Fluids—Steam Velocities—Thermal Units and Thermo-Dynamic Formulæ—Steam Velocities and Turbine Blade Velocities. Chapter II. Elementary Turbines. Reaction Wheels or Hero's Turbines—Compounding Turbines, Vortex Wheel—De Laval Nozzles and Turbines. Chapter III. Turbine Wheels in Series. Early Multiple Wheel Turbines of Pilbrow and Wilson—Reduction of Turbine Wheel Speeds by Series—Steam Packing Glands—Expansion by Stages—Determination of Dimensions—Influence of Blade Angles and Lengths—Vacuums and High Vacua—Leblanc Ejector Vacuum Pump—Parsons Vacuum Intensifier—Marine Turbine Arrangements—Exhaust Turbines. Chapter IV. Calculating Principal Dimensions. Thermal Velocity Curve—Calculating Fall in Thermal Energy—Principal Dimensions of Impulse Turbines—Howden's Impulse Turbine—Results of Tests—Approximate Dimensions—Guide Blades and Wheel Blades—Speed Gearing—Electrical and Mechanical—Measuring Torque and Calculating Horse-power from Torque Measurement—Messrs. Denny Brothers and Dr. Fottinger's Torque Power Indicators. Chapter V. The Construction of Turbine Wheels. Turbine Blades—Guide Blades—Impulse Wheels and Reaction Wheels—Brush Parsons Turbine—Mixed Turbines. The book makes a very favorable impression both as regards the treatment of the subject and the publishers' technique, and should prove valuable as a concise presentation of the fundamental facts and principles of turbine design.

THE DESIGN AND CONSTRUCTION OF INTERNAL-COMBUSTION ENGINES. **A Handbook for Designers and Builders of Gas and Oil Engines. By Hugo Güldner. Translated, with additions on American engines, by H. Diederichs. New York: D. Van Nostrand Company, 1910. 4to.; 690 pp.; with 728 illustrations and 36 folding plates. Price, $10 net.**

To Germany must be given due credit for the highly efficient gas-engine that is serving us so well and in such varying capacities in the industries and recreations of to-day. There is no little literature on the subject, but the author's point is well taken when he says that almost all this literature is devoted to the general construction of existing engines rather than to the details of the problems involved; hence they are of little real help to the practical designer. This work is not a popularly written treatise for the layman, but a thoroughly reliable handbook for the designer and builder. Its first part reviews and criticises the older types of engine; its second part critically examines the various events of the gas-engine cycles; and its third and most extensive part is presented as an every-day working guide, aimed to save much unnecessary and costly experimentation. The drawings are true to detail, show approved designs, and give as many dimension figures as possible. Another section of the work takes up fuels and combustion. Great stress is laid upon the fact that air is power, as far as the gas-engine is concerned, and a realization of this fact means economy of fuel. A concise treatise on thermodynamics and thermochemistry is appended, together with miscellaneous information which will prove of occasional use and value.

HANDBUCH FUR HEER UND FLOTTE. **Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Leipzig: Deutsches Verlagshaus Bong & Co.**

This installment of the "Handbuch für Heer und Flotte" is devoted to a very comprehensive discussion of the subject of the history of fortifications. The author is Lieut.-Col. Frobenius. Beginning with a discussion of the ideas of the Egyptians and the military engineers of ancient Asia Minor, Lieut.-Col. Frobenius takes us to Greece, Rome, and shows how the great captains of the middle ages applied engineering for military uses. The developments of the Russian-Japanese war fittingly close the article. The article is not merely a chronicle, but shows admirably the evolution of modern ideas of fortification.

ELEMENTARY PRACTICAL MECHANICS. **By J. M. Jameson. New York: Longmans, Green & Co., 1911. 12mo.; 323 pp.; illustrated. $1.60 net.**

Designed as a text book for elementary technical schools, it seeks to avoid mere theoretical or mathematical demonstration, rather carrying its lessons into the domain of practical, everyday life. To this end, work, friction, power transmission, and similar subjects are discussed in detail, with the addition of a chapter on elasticity and stress of materials. Much space is devoted to problems, in the conviction that carefully selected problems are in the highest degree illustrative and enlightening.

A SYSTEMATIC EXPLORATION OF THE NORMAL KNEE-JERK. **By Raymond Dodge, Ph.D. (Reprint from Zeitschrift für Allgemeine Physiologie). Jena: Gustav Fischer, 1910.**

A sharp tap given to the tendon of the muscle in which the knee-cap is lodged produces the well-known "knee-jerk," a phenomenon which is extensively made use of as a diagnostic test for a variety of pathological conditions of the nervous system. This phenomenon is of considerable interest, partly owing to its clinical value, but also on purely scientific grounds. Its exact nature has been a matter of some dispute. Some doubt has been expressed as to its true reflex character, i. e., as to whether the stimulus applied is carried to the central nervous system, thence to send out the motor impulse. Some have maintained that the entire action arises within the muscle itself. Thus the "so-called patellar reflex" or knee-jerk forms from several points of view an interesting subject for study.

The publication under review represents the author's reports of a series of accurate and elegant experiments carried out to elucidate some of the problems of the case. Of the conclusions reached we may here mention just one, namely, that the bulk of the evidence seems to point to a true reflex action as the cause of the knee-jerk.

INDUSTRIAL ACCIDENTS AND THEIR COMPENSATION. **By G. L. Campbell. New York: Houghton Mifflin Company, 1911. Small 8vo.; 105 pp. Hart, Schaffner and Marx Prize Essay.**

This little book, presenting a good deal of information in condensed form, should be read not only by the industrial employer and employee, but by all who take a healthy interest in the welfare of their fellow men and of the community. Its scope and the arrangement of the subject matter may be gathered from the chapter headings, which are as follows: 1. Statistics of Industrial Accidents. 2. The Social Cost of Industrial Accidents. 3. Voluntary Agencies Compensating Industrial Accidents. 4. Employers' Liability in the United States. 5. Employers' Liability Insurance. 6. Conclusion and Suggested Reform.

It may be of interest to quote here a few of the most striking statistical data given. From the bulletins of the Interstate Commerce Commission the following figures relating to accidents on American railways are gathered:

"During the seven years ending with 1908, 23,895 employees were killed and 335,964 were injured on the railways of the country. A study of the ratios indicates that the average employee may count on one chance in 414 of violent death within a year. If he prefers to consider the prospect of injury, there is one chance in twenty-nine that an accident entailing at least four days' disability will befall him. If he looks forward to seven years of railway employment, he faces one chance in fifty-nine of death by accident, and one in four of injury. The outlook for a trainman is still worse. Of his fellow workers, 14,888 were killed and 218,082 were injured during the seven-year period. In a given year he has one chance in 127 of death, and one in nine of injury. Seven years in the train service offer him one chance in eighteen of death, and, if his place is one of average danger, present a practical certainty of injury."

A comparison of the conditions in this country and abroad is painfully instructive:

"In the United Kingdom one man is killed yearly on the railways for each 1,427 employed; in the United States it is one for each 414. In Great Britain one man is injured for each 150 employed; in the United States, one for each 29. In England, on the other hand, 9.5 per cent of all accidents to railway employees, are fatal, as compared with 6.7 per cent in America."

One would be inclined to ascribe the last mentioned observation to the fact that the accidents which are most readily avoidable by the exercise of care are the "minor" accidents, which do not contribute so heavily to the list of fatalities.

The appalling significance to the community of industrial accidents is brought out in lurid colors by a table which shows among other things that during the ten years ending 1908 there were killed in Illinois and Pennsylvania 11,328 miners, leaving 6,183 widows and 14,444 children.

From the closing chapter, in which the author presents his views as to the remedies that should be provided for the present condition, we may quote one brief passage:

"In spite of all possible precaution, many workingmen are sure to be killed and injured. Neither employers nor employees are at fault in such cases, but since such accidents seem necessary in the creation of economic goods, the burden should be placed, through the employer, upon the ultimate consumer of the finished product."

The book is intended as a brief outline, a guide giving the main landmarks of a subject on which volumes might be written, and seems to be well qualified to fulfil the claims expressed in the preface by the author, when he says:

"It is the hope of the writer, however, that its very brevity will commend this little book to many persons who, lacking the time for consulting a large number of public reports and other sources, desire a general knowledge of the problem presented."

METODO PRACTICO PARA APRENDER A ESCRIBIR POR EL TACTO Y SIN NECESIDAD DE INSTRUCTOR. **Por J. Martinez, E.M. New York: The Underwood Typewriter Company, 1910. 8vo.; 40 pp. Price, $1.**

A method for self-instruction in the operation of the typewriter by touch. Practical exercises in the form of letters, statements, and bills are given, with the purpose of initiating the learner into the most difficult requirements of actual business transactions.

THE STONE AGE IN NORTH AMERICA. **An Archæological Encyclopedia of the Implements, Weapons, Utensils, etc., of the Prehistoric Tribes of North America. With More Than Three Hundred Full-Page Plates and Four Hundred Figures Illustrating Over Four Thousand Different Objects. By Warren K. Moorehead, A.M. Boston: Houghton Mifflin Company, 1910. Two volumes. 8vo.; 900 pp. Price, $5 net.**

The author believes there is a distinct need for a work of this nature. The "Handbook of American Indians," published by the Smithsonian Institution in 1907, deals so largely with Indian life of the past two centuries, that its consideration of prehistoric life and customs as revealed by the implements and objects that have come down to us is of necessity restricted. Prof. Moorehead's twenty-five years of activity in archæological research, and the distinguished position which he occupies, lend authority to his published facts and deductions. He describes the implements, ornaments and utensils, not according to the locality in which they are found, but by the classes or types. Volume I is devoted to objects of chipped and ground stone. Volume II takes up objects of shell, bone and copper; textile fabrics, wood and pottery. The processes by means of which these articles were made are painstakingly described, with a wealth of diagram and illustration. A strong light is thrown upon the ingenuity and craftsmanship of a most interesting race, and we leave the perusal with an increased respect for the skill and artistry revealed by their achievements. The colored plates, many of them donated by wealthy collectors, can hardly be over-praised. They are fine examples of modern perfection in illustration. The whole work is scholarly in text and beautiful in make-up and finish.

GRAVESEND. **The Water-Gate of London. With Its Surroundings. By Alex. J. Philip. New York: Frederick Warne & Co., 1909. 12mo.; 120 pp.; with maps and illustrations. Price, 25 cents net.**

DOVER. **With Its Surroundings. By Henry Harbour. New York: Frederick Warne & Co., 1908. 12mo.; 80 pp.; with maps and illustrations. Price, 25 cents net.**

BURY ST. EDMUNDS. **With Its Surroundings. By W. A. Dutt. New York: Frederick Warne & Co., 1908. 12mo.; 76 pp.; with maps and illustrations. Price, 25 cents net.**

TINTAGEL, BOSCASTLE, AND THE NORTH COAST OF CORNWALL. **By Beatrix F. Cresswell. New York: Frederick Warne & Co. 12mo.; 96 pp.; with map and illustrations. Price, 25 cents net.**

These are all of the well-known "Homeland" series of handbooks, invaluable to tourists and visitors. Most of the guides contain an ordnance map on the scale of one inch to the mile. All are replete with historical lore and present-day information, and are rich in really good plates and illustrations. It seems very extraordinary that this series of handbooks which is so well-known in England should be so little known here. The plan of the books is excellent. There are many other books in the series.

ELECTRICITY EXPERIMENTALLY AND PRACTICALLY APPLIED. **By Sydney Whitmore Ashe, B.S., E.E. New York: D. Van Nostrand Company, 1910. 12mo.; 375 pp.; 422 illustrations. Price, $2 net.**

As the work is intended for the beginner no less than for the practical man, there is first a statement of general principles and laws, illustrated by simple experiments. Batteries, meters, motors and illuminants are thoroughly explained, and there is a chapter on projection apparatus, written especially for the teacher.

THE TRISECTION OF ANY RECTILINEAL ANGLE. **By George Goodwin. Ottawa, Canada: Copeland-Chatterson-Crain Press, 1910. 21 pp.**

The solution is based upon the theorem that if the side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

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Inquiry No. 9239. Wanted, addresses of parties who can ship ores containing any of the following elements: Vanadium, molybdenum, uranium, tungsten, titanium.

Monsters of Bygone Ages

(Continued from page 358.)

creatures that ever lived. They varied alike in size and appearance to a remarkable extent. Some of them had smooth skin, while others wore a defensive armor and bony plates. Some were vegetable feeders and others carnivorous.

The second creature to be erected at Stellingen was a representation of the diplodocus. It measures some 66 feet in length and is virtually a duplicate of the skeleton in the American Museum of Natural History with the flesh on. It will be recalled that this particular skeleton was obtained in 1899, from the famous Bone Cabin Quarry, in Central Wyoming—a veritable graveyard of prehistoric animals and the richest deposit of fossil-remains known. Like many other great "finds" it was discovered by accident. In the days when this animal and its fellows were alive, the country which now comprises Wyoming, Montana, Colorado, New Mexico and the Dakotas possessed a tropical climate, not unlike that of Brazil to-day, a region including great lakes of salt or brackish water, the sedimentary remains of which form the "bad lands" of our day.

The diplodocus had a long, thick tail like a lizard, a long, flexible neck, like the ostrich, a thick, short, slab-sided body, and straight massive, post-like limbs, suggesting the elephant. When alive such a creature would turn the scale at 25 to 30 tons. The animal was amphibious, living chiefly in shallow water, feeding upon the abundant vegetation. Although the biggest creature that ever walked on four legs it was singularly ill-fitted for holding its own in the struggle for existence, and was no doubt killed off by the smaller but more powerfully-built carnivorous dinosaurs of that age. It possessed a very small brain, and even in those early days brain and not bulk counted much in the struggle for existence.

Another strange dinosaur, of which Hagenbeck had made a striking life-like representation, was the stegosaurus, so called on account of the broad plates forming a double ridge extending along its back. This was one of the mightiest of all dinosaurs. Its length was about 25 feet. Some of the bony plates on its back were as much as a yard in width. Its tail was armed with eight spikes or spines. More than twenty specimens of this interesting monster have been discovered in the Rocky Mountains by Professor Marsh. The teeth showed that it was a vegetable feeder. The spinal cord near the hind legs was greatly enlarged, a fact which is not easily explained unless we may suppose that the movements of the tail were directed from this center.

The last, and in some ways the strangest of all the dinosaurs, was the triceratops, whose remains have been found in the cretaceous strata of the Rocky Mountains. At Stellingen two full-size representations of this wonderful creature have been erected, one partially submerged in the lake and the other standing upon the bank, as well as a baby triceratops. The full-grown figures are about twenty-five feet each in length. Skulls of this animal which have been unearthed in the Rocky Mountains have measured over seven feet in length.

The most remarkable feature about this creature is the unique way in which the bones forming the back of the skull are developed into a great collar or fringe; the very pointed and triangular shape of the skull is also remarkable. In some respects the creature resembles the rhinoceros, but unlike the river-horse of today it carried three horns upon its face and with its collar of formidable spines it must have presented a terrible appearance. Its brain, however, was extremely small. Prof. Marsh is of the opinion that this species became too "specialized" and died out—the usual end of a too great ambition! There are other specimens of the dinosaurs, an interesting representation being that of one of the carnivorous dinosaurs, allosaurus, shown in the act of feeding.

Before the coming of the dinosaurs the world was populated with those strange creatures, the plesiosaurians or sea lizards, curious creatures, half fish and half reptile. One of these has rightly been included in this unique exhibition of prehistoric wild-life at Stellingen, in a life-size figure of the Plesiosaurus victor. This beast possessed a long neck, like a serpent, the head of a lizard, the teeth of a crocodile, the ribs of a chameleon and the paddles of a whale. It is, however, smaller than the whale of today, being some twenty-two feet in length. It probably could swim under water as well as on the surface and when in the latter position could snap up small lizards and birds from the land, as it lived entirely on flesh, being carnivorous.

Altogether, the collection includes some thirty of these prehistoric beasts. There are extinct crocodiles and fishes and curious fin-backed lizards. These last have comparatively speaking small bodies and a curious erection down the center of their back like a frill. They are shown standing on the banks while a few are depicted swimming in the water. Near where these animals have been erected is the new insect house of the park. The outside wall of this structure is composed of artificial boulders built up in the form of steps. Upon these have been placed huge flying creatures of uncouth form, and specimens of extinct birds.

Public Roads

INSTRUCTION in the methods of road building has continued through the medium of object-lesson roads, built at local expense, under the supervision of an engineer of the Office of Public Roads. More than one million square yards of road, equivalent to about 14 miles of road 15 feet wide, were completed during the year. Viewed as a construction record alone this would constitute an excellent showing, but when it is considered that this mileage was made up of 55 object-lesson roads, each constituting a miniature school of road building, comprising ten distinct types of construction, it must be evident that this feature of the department's work is a powerful factor in the promotion of the movement for the betterment of the public roads.

An inspection last year of twenty-two object-lesson roads, aggregating about twenty-two miles, showed that their effect upon the different localities had resulted in the building of 730 miles of additional roads according to the same methods, and had brought about the expenditure, through bond issues, of $1,500,000.

Advisory work relating to road problems necessitated about 250 assignments for the department's consulting engineers and experts. This was an increase of about 70 per cent over the amount of like work performed during the preceding fiscal year.

Irrigation Investigations

THE Office of Experiment Station has endeavored to enlarge its plans to meet the demands for information. In the past, water for irrigation purposes was plentiful, and in the old-school method of use great quantities were wasted. In many parts of the West this old method still prevails, but the improved principle of irrigation advocated by the department is rapidly displacing those of former days, and good results are noticeable. When the irrigators of the San Joaquin Valley first began irrigation they used over nine feet. About one-third of this is found to be ample. The water users of Greeley and neighboring districts in Colorado thought their crops would burn up unless they had a miner's inch of water to the acre. Now they are raising crops on the same ground that are worth about four times as much with one-fourth the water formerly used. So important is the need of furthering the investigation of irrigation that several Western States are now co-operating with the department in the prosecution of the studies. Irrigation is being taken up in humid regions also in order to insure against droughts.

Aviation Awards.—The Royal Aero Club have made the following awards: Special gold commemorative medal, the late Mr. Cecil Grace (who was drowned while flying the channel). Gold medal, Mr. Grahame-White, for his victory in the Gordon Bennett Cup race. Silver medal, Mr. Robert Loraine, for his flights from England to Ireland.

Aeronautics

Probable Abandonment of Paris-Berlin-London Aeroplane Race.—The proposed international cross-country race from Paris to Berlin and thence to London via Brussels, with a return trip to Paris, will probably be given up on account of the stand taken by the leading Parisian papers with regard to promoting aviation in Germany. The Paris *Journal* has withdrawn its support, and as a consequence the leading Berlin newspaper will apply the $25,000 which was offered to some other event for German aviators only.

Record Cross-country Flights in Germany.—On March 28th Lieut. Erler flew with a passenger from the Doeberitz aviation field, near Berlin, to Hamburg, a distance of 140 miles in 3½ hours. This is the longest cross-country flight ever made in Germany. The following day Lieut. Erler continued his journey to Bremen. He covered this second stage at a rate of 57 miles an hour according to the cable report; and on March 30th he continued the trip to Hanover. This excellent series of flights by a military aviator shows that Germany is catching up to France in the field of military aeronautics.

Need of a Compass.—How great is the need for a magnetic compass that shall remain unaffected by engine vibration on an aeroplane was forcibly brought home by the sad fate of Cecil Grace. The problem is now receiving serious attention. One of the Brookland aviators, Mr. Ducrocq, is using an interesting compass lent to him for trial by a naval officer, who has employed it with success in submarine work. It consists of the usual mariner's compass, floating in oil, contained in a case which rests in a bed of horsehair. The horsehair is not packed at all densely, but its springiness is so great and enduring that it makes an excellent protection against the vibration of the motor.

End of the Wright Suit in France.—A suit of the French Wright Co. against Blériot and other leading French constructors was brought to an end on March 30th by the summing up of the case by the State attorney, who declared that the Wrights had not established an infringement, while, on the other hand, the defendants had failed to invalidate the patent. It is expected that the decision will be handed down on the 29th instant. Wilbur Wright was present and testified in person. His brother, Orville, who remained at home, is said to be experimenting at the present time with an automatic stability device which will render the brothers' biplanes more easily controlled and more safely operated.

Elimination Race for the Bennett Aviation Trophy.—Belmont Park has been turned over to the Aero Club of America by its owner and the executive committee of the club has set the dates of May 19th, 20th, and 21st for the elimination race to select representatives of this country on the team which will be sent to England in the endeavor to regain the trophy captured last fall by C. Grahame-White. Mr. Robert F. Collier has put up a $5,000 cup for the winner of the elimination race. The committee reserves the right to appoint other aviators, for example, Messrs. Martin and Weyman, who are flying abroad, in case it seems probable that these men would stand a better chance of winning the trophy. The date of the race in England has been changed from June 28th to July 1st.

A Record Cross-country Flight in France.—In an attempt to win the Aero Club trophy for the quickest flight from Paris to Pau, a distance of over 400 miles, M. Vedrine left Paris at 6 A. M. on March 28th in his Morane monoplane. He reached Poitiers (180 miles) in 3 hours and 10 minutes, but was obliged to abandon his journey there on account of a breakdown. Three days later he flew back to Paris in the record time of 2 hours and 12 minutes, or at an average speed of 82 miles an hour. The fact that Vedrine made the return flight in two-thirds of the time taken on the outward journey would indicate that he was favored with a wind of between 25 and 30 miles an hour on his way back. He expected to try again for the trophy. His monoplane, he claims, has a speed of 70 miles an hour, although it is driven by but a 50 horse-power motor.

Electricity

The Navy Wireless Telegraph Station.—It was recently announced that the high-powered wireless telegraph station of the Navy Department is to be located on the southwest corner of the Fort Myer reservation. Here a number of towers, 450 feet high, will be erected, for the purpose of supporting the antennæ. They will be arranged either in a triangle or a quadrangle. The effective radius of the station will probably be 1,500 miles. It was originally proposed to use the Washington monument for supporting the antennæ, but owing to public sentiment, the plans were changed.

Swedish Farmer's Power Station.—The farmers in the province of Skane, Sweden, have organized to build a central station to furnish their farms with electric current. This will be used mainly to take the place of mechanical power on the farm, but also for lighting as well. In another section of Sweden, the farmers have organized a company which will buy current from a power station, and distribute it to the various farms. The power is purchased at 2½ cents per kilowatt hour, and is sold for 5½ cents per kilowatt hour. The stock of this company is divided among the farmers in proportion to the amount of energy they use.

Electricity in Indian Mills.—The mills in Bombay are driven by steam power largely at present, and this proves to be very costly. A scheme is being started to generate the power required from stored water. Water is to be collected during the monsoon and stored in huge reservoirs up in the ghats about forty miles from Bombay. The valleys which are being dammed are in close proximity to a fall of 1,740 feet, and it is the power from that fall which is to be utilized. The transmission line to Bombay is about 43 miles long, and a voltage of 80,000 will be used in the line. In Bombay it will be transformed to varying voltages for distribution to consumers, which will be principally the cotton mills. These mills alone now use about 100,000 horsepower.

No Secret Telegraphy.—Many persons are of the impression that wireless telegraphy is particularly subject to "tapping," but, as has been pointed out by Marconi and others, no telegraph system is absolutely secret. Any one familiar with the Morse code can read ordinary messages entering any telegraph office. At Poldhu, on a telephone connected to a long horizontal wire, the messages passing on a government telegraph line a quarter of a mile away can be distinctly read. It has been shown that it is possible to pick up at a distance, on another circuit, conversation which may be passing through a telephone, or telegraph, wire. On one occasion an investigator was able to interfere, from a distance, with the working of the ordinary telephones in Liverpool.

Ball Lightning Due to a Bend in a Conductor.—Ball lightning was observed at La Rochelle, France, on December 15th last, under the following curious circumstances (as described in *Cosmos*): An ordinary lightning discharge struck the antenna of a Turpain thunderstorm-recorder (ceraunograph). The antenna, which consisted of 2-millimeter copper wire, and had a total length of 100 meters, was attached to a factory chimney; at a certain point it bent at a sharp angle (25 degrees). The lightning volatilized the wire as far down as the bend. Here the discharge divided; part continued to follow the antenna and demolished the thunderstorm-recorder; another part cut a neighboring telephone wire and six iron guy-wires; while a third part apparently left the conductor in the form of a ball of lightning, which exploded 20 meters away from its point of origin, breaking a window. M. Turpain believes the production of the ball was due to the self-induction of wire at the bend; the discharge passing at this point into the air, which offered less impedance than the bent wire. The occurrence promises to throw some light on the mysterious question of the origin of ball lightning. M. Turpain proposes to try to reproduce the phenomenon by setting up several similar antennæ on the estate of Mauroc, belonging to the University of Poitiers, which lies in a region of frequent thunderstorms.

Engineering

Motor-driven Warships.—Germany is making a test on a large scale of oil engines for warships. Three sets of motive machinery, each containing three 2,000 horse-power cylinders, are being manufactured. One set of 6,000 horse-power will be tested on shore. If results are favorable, the three sets, aggregating 18,000 horse-power, will be mounted in a triple-screw protected cruiser. The engines are said to be of the Diesel reversable type.

New Zealand Believes in Ship Subsidies.—While the American merchant marine seems to be within measurable distance of extinction, that of other nations is being made the subject of generous government assistance. The latest instance of this is in that enterprising colony, New Zealand, which, in spite of its being to-day the chief exponent of socialism, has recently voted a subsidy of $100,000 a year for a mail service between Vancouver, Auckland and Sydney.

A New Elswick Fourteen-pounder.—There is much interest just now in a fourteen-pounder rapid fire gun, which has been built and tested by the Elswick firm. The novelty lies in the recoil cylinders, which, in place of the customary springs, are filled with a mixture of liquid and air. In trial tests, the gun has fired ten rounds in succession without relaying. There was no disturbance of the sighting, and five successive shots, it is said, were placed in exactly the same hole in the bull's eye.

New Railroad Track Scale.—The Pennsylvania Railroad has installed a scale for weighing cars in motion which is provided with a relieving gear—an arrangement of jacks operated by power—which permits the scale mechanism to be completely disconnected from the track, thus allowing the heaviest engine to pass over the scale without registering any weight. The scale is provided with a "mechanical hump," by which it is possible to regulate the velocity at which the cars go onto the scale.

Remarkable Trolley Wire Service.—The New York, New Haven and Hartford Railway engineers are much pleased with the durability shown by the new trolley wire of the electric service. One length of this wire, after being in service at the Stamford yards for nearly two years, during which 85,000 locomotive movements had taken place below it, showed a reduction in thickness of the lower half of the wire of only 14 per cent. At this rate, a wire in service on the main line should last for over forty years.

Oil Fuel on an Eastern Railway.—The New York, New Haven and Hartford Railway is converting twenty-two coal-burning locomotives into oil burners. This change is to be made on the strength of the good results shown in tests which the road has been quietly making for some time past. The Cape train between the South Station, Boston, and Provincetown, has been used for the test, and it is stated that a saving of approximately $12.00 a day in running expenses has resulted from the change.

British Target Practice.—Although the conditions of target practice have been made more difficult for the gunner, the number of hits has increased in the British navy. The target, towed at an unknown speed, is 30 feet high by 90 feet long, the latter dimension being less than one-fifth the length of a modern battleship. During 1910, the 10 and 12-inch guns averaged 0.7 hits per minute against 0.4 four years ago. The 9.2-inch guns for the whole fleet averaged 2.01 hits; the 7.5-inch gun made 2.61 hits, as against 1.58 made by this gun four years ago.

Fast Long-distance Railroad Run.—A new four-coupled express passenger locomotive which has recently been built at the shops of the Pennsylvania Railroad Company, recently made the run from Altoona to Philadelphia, a distance of 235 miles, in 209 minutes. The distance from Altoona to Harrisburg, 131.1 miles, was made in 113 minutes, at the rate of 69.7 miles per hour, and from Harrisburg to Philadelphia, 104 miles, the running time was 96 minutes, at an average speed of 65.0 miles per hour. Reduction of speed in the city limits, Philadelphia, brought down the average, which, for the entire 235 miles, works out at 67.4 miles per hour.

A Valuable Suggestion

To our subscribers *only*

IN response to our recent invitation to our subscribers for expressions of their opinions regarding the greater Scientific American we have received many valuable suggestions. All of the letters express approval and satisfaction with the changes made in the magazine and not a few are indicative of a desire on the part of the writers to co-operate with us.

The Scientific American's best friends are its subscribers, and as a result of their enthusiasm we have in the past added many new subscribers to our list. We have, therefore, evolved a plan whereby our subscribers may be benefitted in return for any help they may give us in increasing the circulation of the new Scientific American.

Here is the way:

Simply send us the names and addresses of the people whom you think will be interested and we will do the rest. An accurate record of all names received in this manner will be kept, and for each subscription we get from any list we will extend the subscription of the person who sent us the list for four months. Thus if we receive three subscriptions from any one list the subscription of the person who sent us the list will be extended for a full year.

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Be careful to write the names and addresses plainly and don't fail to put your own name and the address at which you are receiving the Scientific American on each list you send.

Address all lists to Circulation Department, Scientific American, 361 Broadway, New York.

Science

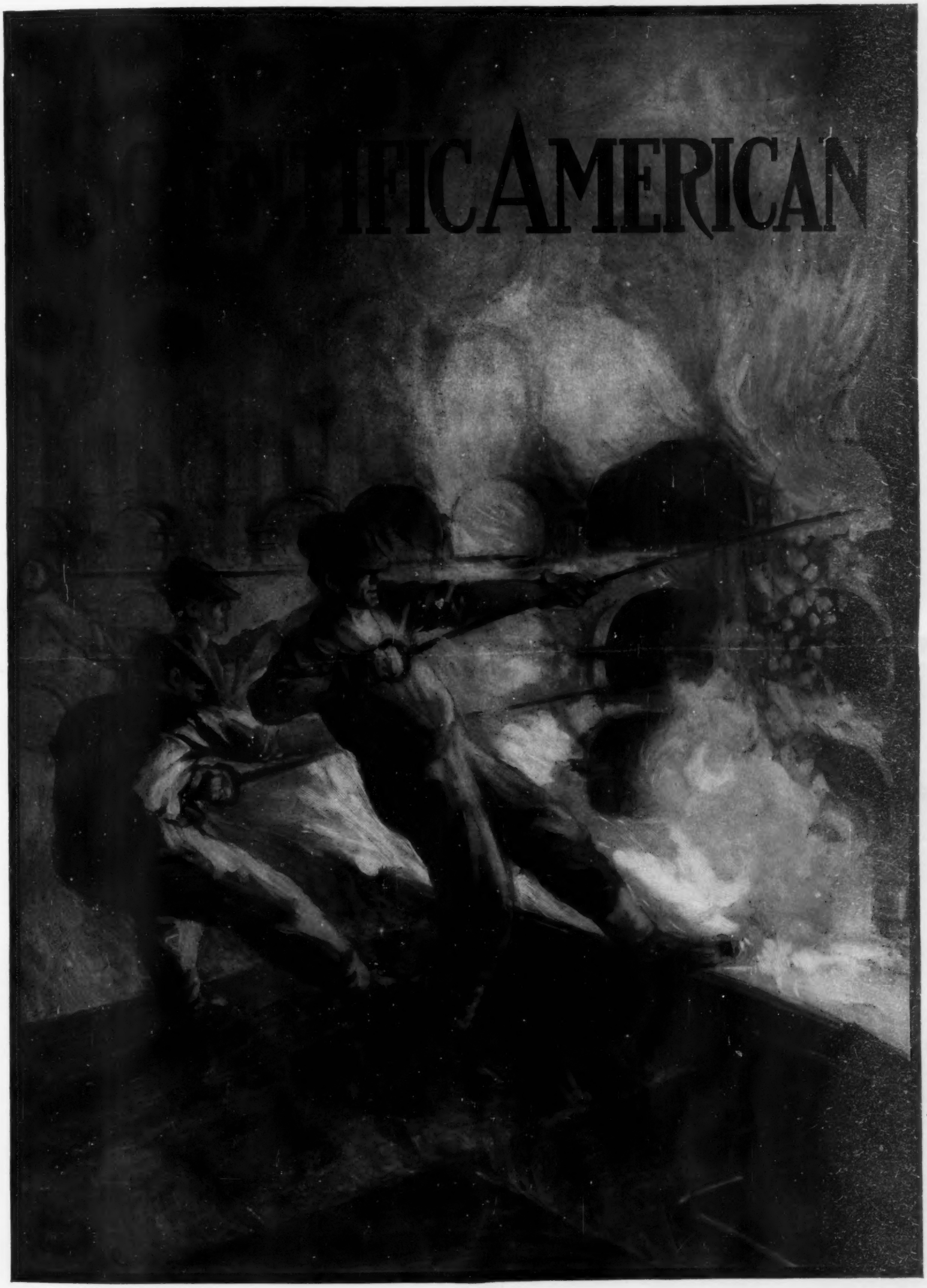
Glass Walls in Fruit Culture.—Fruit culturists abroad have recently essayed the use of fruit walls of glass instead of masonry, with interesting results. With a glass wall the same kinds of fruit can be grown on both the north and south sides. The results in the case of pear trees are said to be most excellent, the fruit grown on the north side of the wall being equal to that grown on the south side, and even smoother. Good results have also been obtained in the case of peaches and apples. The principal objection made to the glass wall is that it does not store up heat like a masonry wall, to keep the plants warm at night; during the day time the heat is nearly equal on both sides of the wall.

Silica Glass.—Such extensive use has been made during the past few years of silica glass for chemical apparatus that it was found necessary to devise a method whereby this glass might be produced in the electric furnace instead of with oxyhydrogen blow pipe. To produce perfectly transparent silica glass from melted quartz an artifice is required, because, on reaching the temperature of 600 deg. C., the quartz splits and minute bubbles of air fill the mass. This can be prevented by first raising the temperature of the quartz to a point little under 600 degrees and then surrounding it with liquid silica, at a temperature of 2,000 deg. C. The liquid silica acts as a shield to prevent the entrance of air when the quartz splits up, and thus the formation of bubbles is avoided.

Keeping the Bee at Work.—The busy little bee at best gets a day off about as seldom as a farmer's boy in haying time, but the modern apiarist has contrived to make her even more industrious than when she is left to herself. The orchards of the Sacramento and San Joaquin valleys blossom some months before the southern sage brush. The bee farmer, therefore, carts his bees about from place to place as the seasons advance, and thus, by keeping them busy nine months of the year, gets three crops of honey. The difficulty of moving bees during their active season is overcome by traveling at night. As the bees help to pollenize the flowers and thus produce superior fruit, the owners of the orchards regard them with favor. In results the plan is even better than that of the enterprising farmer who crossed his bees with fireflies so that they could work nights.

Dr. S. F. Emmons.—Dr. Samuel Franklin Emmons died on March 28th in Washington at the age of seventy. He was a graduate of Harvard, and of the Ecole Imperiale des Mines. He first came into notice for work done in connection with the United States geological exploration of the fortieth parallel. His writings on the science of ore deposits and mountain building are well known among geologists. He has been connected with the United States Geological Survey since 1879. He was general secretary of the International Congress, and its vice-president from 1891 to 1903, and treasurer of the National Academy of Sciences. He was an honorary member of the Philosophical Society, an Associate Fellow of the American Academy of Sciences, an honorary member of the Canadian Mining Institute, a Fellow of the London Geological Society and other geological organizations.

Amundsen in the Antarctic Region.—Word has been received from Capt. Scott that Amundsen, like himself, is trying to reach the South Pole. Scott's ship, the "Terra Nova," has returned to New Zealand after landing sledge parties on the ice, and has brought messages from Capt. Scott himself. It seems that Lieut. Pennell, of the expedition, found the "Fram," Amundsen's ship, in Iceland Bay, and a Norwegian party fully equipped for a journey to the South Pole. On board the "Fram" were eight men and sixteen Greenland dogs. In April, 1909, Amundsen stated that he intended to go to the North Pole. He left Norway ostensibly to travel *via* Cape Horn and Bering Strait to the North Polar Basin. On arriving at Madeira in October, he announced that he had changed his plans and was going to try for the South Pole. Nothing had been heard of Amundsen's expeditions until news was received from Scott.



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The Flying Machine and the Airship

THE MAY MAGAZINE NUMBER OF THE SCIENTIFIC AMERICAN ISSUE OF MAY 13th, 1911

"The way of a bird in the air" is no longer as mysterious to us as it once was to Solomon. We have much to learn, however, before we can plow the invisible ocean of the atmosphere with the ease and the safety and the marvelous economy of power which characterizes the flight of every hawk or buzzard—how much, every reader of the Scientific American will realize when he reads the May Midmonth Number of the Scientific American, which will be devoted largely to aviation and airshipping.

"In part a flying machine and in part a death trap," comments one of the contributors to that issue, "the aeroplane has done both more and less than its sudden arrival among the great inventions of the age had promised. . . . This combination of a Chinese or a box kite, an automobile motor, a restaurant fan, balloon rudders, junior bicycle wheels and ski runners, the whole strung together with piano wire and safeguarded with adhesive tape and mammoth rubber bands, spring from toyland into the world of industry, politics, warfare and finance, when two plodding and practical tinkers of genius—self-made engineers from the American school of try, try and try again—prove that they could balance and steer it by a twist of its muslin."

That is a little severe, perhaps. Yet, it drives home the defects of our present methods and of our haphazard and slap-dash construction.

First of all, the problem of automatic stability presents difficulties that few realize. Even a hawk finds it hard to keep on an even keel. To relieve strain on nerves and muscles in warping a plane or throwing an aileron up or down, many inventors have patented devices which, in their opinion, would balance a machine automatically. In the May mid-month number you will find the principal automatic stability devices patented in this country, collected and explained by Mr. Grover Cleveland Loening, and their mechanical merits or fallacies set forth. Here is a fruitful field for invention of the right kind, and the alleged automatic mechanisms which Mr. Loening holds up for contemplation are, many of them, at least instructive in so far as they tell the inventor what he must avoid and why.

A first cousin to the automatic stability tinker is the man who plucks, as it were, a flying machine out of his mere imagination, knowing nothing of the basic principles laid down by Langley, Chanute, Maxim, and the Wright Brothers. Mr. Morris Krarup will reveal these absurdities in a merrily written and biting article which is fittingly entitled "The Chamber of Horrors."

Accidents, too, will receive the attention that they deserve. It may be true, as one enthusiast has observed, that aviation has fewer deaths to its discredit in its early stages than had the automobile; but it is also true that ignorance, folly and recklessness have been all too apparent in the ghastly fatalities that make unpleasant reading in the newspapers. "The Coroner's Inquest" is the title of an article in which the cause of these aviation accidents is set forth, and the pictures that will accompany that article will show how tragically complete is the ruin of a flying machine that has come to grief.

Marvel as we may at the wonderful ingenuity displayed in the flying machine, we have still much to learn from soaring birds. The condor has a supporting area of nearly ten square feet and a weight of seventeen pounds. It flies with an expenditure of about 0.05 horse-power. Most aeroplans use engines of 50 horse-power. To be sure they have a greater spread of wing and weigh much more than a condor. But what a difference between 0.05 and 50! Part of this waste of energy is due to the propeller. Assistant Naval Constructor William McEntee, in an article on "Air Propellers," will show how wasteful of power is the screw propeller and along what lines improvement must be made.

In our admiration of the heavier-than-air flying machine, we have in this country been quite blind to the remarkable developments made in Europe, in the construction of dirigible airships. Mr. Carl Dienstbach will critically discuss the leading types which have been developed in France, Germany, and England, and will contrast the one type with the other.

All these articles, mind you, are published in addition to the regular Scientific American articles. There will be the usual Inventor's Department, the Scientific Abstracts from Current Periodicals, the Editorials, and the live and interesting features that make the Scientific American what it is from week to week.